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Impact of the Gamification-Enriched Hybrid Information Literacy Education on Student Achievement[1]

Oyunlaştırılmış Bilgi Okuryazarlığı Hibrit Eğitiminin Öğrenci Başarısı Üzerindeki Etkisi

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Öz

Dersin öğrenme çıktılarına ulaşılmasında öğrenme etkinliğinin daha verimli ve öğrenci odaklı hale gelmesini sağlayan yenilikçi öğrenme metodolojilerinden biri oyunlaştırmadır. Bu çalışma kapsamında oyunlaştırılmış Bilgi Okuryazarlığı (BOY) Dersinin öğrencilerin başarım durumu üzerindeki etkisini belirlemek ve derslerin oyunlaştırılmasına yönelik algı ve motivasyonu ortaya koymak amaçlanmıştır. Literatürdeki mevcut BOY eğitim ve öğretim programları, müfredatlar ve oyunlara dayanarak oyunlaştırılmış BOY programı tasarlanmıştır. BOY programının içeriği yedi farklı modül olarak hazırlanmıştır. Bu kapsamda, ŞARLOT Kütüphanede İşbaşında BOY oyunu ve animasyon videoları hazırlanmıştır. Oyunlaştırılmış BOY programının yanı sıra, geleneksel BOY programı da tasarlanmıştır. Uygulama, 2020-2021 akademik yılının güz döneminde Ankara Yıldırım Beyazıt Üniversitesi Yönetim Bilişim Sistemleri bölümünde ikinci sınıf öğrencileri ile 13 hafta boyunca gerçekleştirilmiştir. Deney grubu kapsamında 21 öğrenci, kontrol grubu kapsamında da 22 öğrenci olmak üzere toplamda 43 öğrenci çalışmaya katılım sağlamıştır. Deney grubuna oyunlaştırma ile zenginleştirilmiş hibrit eğitim yöntemleri uygulanırken, kontrol grubuna geleneksel eğitim yöntemleri uygulanmıştır. Eğitimin başarım üzerindeki etkisini belirlemek amacıyla eğitim öncesinde ve eğitim sonrasında öğrencilere ön test ve son test uygulanmıştır. Ön test ve son test sonuçları oyunlaştırma ile zenginleştirilmiş hibrit eğitim alan deney grubunun yüksek düzeyde başarım sergilediğini göstermektedir. Bu durumun oyunlaştırılma ile zenginleştirilmiş hibrit program kapsamında oyun ve animasyon videoları ile pekiştirmenin sağlanmasıyla ilgili olduğu düşünülmektedir. Bulgular geleneksel eğitim yöntemlerinin oyunlaştırılmış yöntemlerle zenginleştirilmesinin derslerin etkinliğini artıracağını ortaya koymaktadır.

Anahtar sözcükler: Oyunlaştırma, oyunlaştırmayla zenginleştirilmiş bilgi okuryazarlığı hibrit eğitimi, bilgi okuryazarlığı, öğrenci başarısı.

[1] This article was based upon the PhD dissertation entitled "Impact of Gamification-Enriched Hybrid Information Literacy Education on Student Achievement" which was completed in the Department of Information Management in Hacettepe University in Turkey in 2022.

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Abstract

Gamification is one of the innovative approaches and methods that foster the learning process to be more efficient and student-centered in reaching the course's learning outcomes. This study aims to determine the impact of the gamified Information Literacy (IL) Program on the students' academic performance and to put forward their perception and motivation towards the gamification of the course. The gamified Information Literacy program was designed based on the current Information Literacy education and training programs, curricula, and games in the literature. The content of the Information Literacy program was prepared in seven different modules. Within this scope, ŞARLOT Kütüphanede İşbaşında (ŞARLOT in the Library) game was designed and animation videos were designed. In addition to the gamified IL program, a traditional IL program was also designed. The program was implemented for 13 weeks with second grade students in the Department of Management Information Systems at Ankara Yıldırım Beyazıt University in the fall semester of the 2020-2021 academic year. A total of 43 students, including 21 students in the experimental group and 22 students in the control group, participated in the study. While gamification-enriched hybrid methods were implemented in the experimental group, traditional training methods were implemented in the control group. In order to find out the impact of the program on performance, pre-tests and post-tests were performed on the students in the pre and post-training periods. The pre-test and post-test results indicated that the experimental group who participated in gamification-enriched hybrid education had a high level of success in the test.
Keywords: Gamification, gamification-enriched hybrid methods, information literacy, student achievement.

Introduction

With the technological developments and digital transformation process in recent years, it has become a necessity to gain digital literacy and information literacy skills. Information literacy skills are significant for professional development, academic success, and creating informed citizenship. In order to create a well-balanced and informed society, it is increasingly vital for Generation Z (Gen Z) to get information literacy instruction and, therefore, to contribute to the participatory and collaborative society structure.Generation Z students are actively using digital platforms, digital tools, and media, and it is becoming highly significant for educators and professionals to guide Generation Z in interacting with information, digital tools, and platforms. Information literacy instruction is a vital 21st-century skill that will help younger students navigate their educational and professional paths.

Providing a well-designed information literacy instruction and teaching it with engaging methods is possible by identifying the learning needs, motivational needs, and expectations of Generation Z students. Within this scope, it is significant to develop learner-oriented, participatory, inclusive information literacy instruction approach and content. Designing the appropriate educational content that matches their learning needs and expectations will help educators and professionals achieve learning outcomes, and it will be easier to create a deep bond between the content and the learner. However, in today's learning environments, traditional methods, which are known as conventional methods, need to be enriched and supplemented with more interactive methods and learner-centered approaches. At this point, gamification, one of the pedagogical and funware-focused educational methods came to the fore complementary to the conventional teaching strategies. Also, it is a methodology that has the highest potential to solve the problems arising in educational environments.

At the forefront of these problems is student motivation and ensuring active participation of students in courses (Lee & Hammer, 2011, p. 1). In today's classrooms, most of the problems arise out of a lack of interest in motivation. Since motivation is considered one of the important components of student academic success (Linehan et al. 2011, p. 1979), which affects the effort and time spent by the student on learning, it is important to understand the psychological needs and learning behaviors of the new generation of native speakers of the digital culture age to learn, motivate and motivate them. It is essential to design learning environments that enable student engagement, participation, and motivation. By this, NMC (New Media Consortium) Horizon Report Higher Education Edition (2013) declares that the age range of 31% of gamers varies between 18-35, and gamification enables the students to acquire new skills through diverse teaching

methods. Therefore, gamified content can boost the student's learning performance. Designing gamified learning content is a preliminary step in comprehending the concept of gamification.

The concept "gamification" was first coined and invented by Nick Pelling (Christians, 2018). It started to gain popularity in early 2010. Since this date, it has been used in various sectors and disciplines, such as gamification, digital media, marketing, business, health sciences, and commerce (Deterding et al., 2011, p.9). One of the sectors where gamification is frequently used is the field of education. Ismail et al. (2021) emphasize that gamification includes fun ware, fun, and ease of use, an essential component for creating an efficient gamified system. These components enable the student to establish a close interaction with the learning material and flow of the course. Gamification is a kind of methodology that enhances student engagement (Bossavit and Parsons, 2018; Camacho-Sánchez et al, 2023).

Gamification is a method involving game mechanics and dynamics in non-game contexts to enrich user behavior and user experience (Huotari and Hamari, 2016) and, it focuses on the concept of " playfulness" (Hamari and Koivisto, 2015). Besides this, gamification is defined as a kind of strategic approach that creates engaging experiences for individuals to achieve the set goals (Huotari and Hamari, 2016). Gamification is a fun-based design for solving problems. It is a motivational design that considers the psychology of the players into consideration. Gamified design uses game elements in non-game contexts to create changes in individuals' behaviors and motivate them (Sanchez and Masegosa, 2020, p. 251). While Koivisto and Hamari (2014, p.179) consider gamification as the process of creating gameful experiences, Werbach (2014) defined game elements and mechanics as the incorporation of mechanics in non-game learning environments. While it is considered important tool in terms of attracting the attention of individuals, facilitating their participation in targeted activities, and influencing their behavior (Kim, 2015). Dichev and Dicheva (2017) defined gamification as boosting participation by involving game elements in an educational setting. By this, gamification aims to enrich specific abilities through joyful design, optimize the learning process, and enable behavior change. Mercan and Selcuk (2024) investigated the impact of game-based learning and gamification strategies in physical education, and findings indicated that gamification had a positive impact on learning performance. Lopes and Fernandes (2024) found that students engaged in the gamified learning setting indicated higher comprehension of SCRUM roles; they had better scores on assessments when compared with their peers who have not participated in their study related to the use of gamification for learning SCRUM. Jaramillo-Mediavilla et al. (2024) conducted a study on the impact of gamification on motivation and academic performance. They found that gamification has the potential to enable the student to practice what he is learning, and the motivated student has a tendency to achieve better scores. Also, studies by Thom et al. (2012), Squire (2013), Mekler et al. (2013), Haaranenan et al. (2014), Huand and Hew (2015), Landers et al. (2017), Sailer et al. (2017), Morschheuser et al. (2017) Öztürk and Korkmaz (2020) Arufe Giraldez et al. (2022), Alsadoon's et al. (2022) put forward the impact of gamification on learner academic performance and success. Moreover, in their study, Dicheva et al. (2015), Yıldız et al. (2021), Sailer et al. (2017), Dominguez et al. (2013), Treiblmaier and Putz (2020) found that gamified tools methods had a positive impact on motivation.

In the literature, limited studies identify the impact of gamified IL instruction on the student's academic performance. The primary purpose of this study is to identify the impact of gamification-enriched hybrid IL education on the academic success of the second-grade students of the Department of Management Information Systems, Ankara Yıldırım Beyazıt University. The scope of the research consists of gamifying the IL educational curriculum and teaching the educational content with hybrid methods enriched with gamification. While preparing the gamification-enriched IL instruction program, IL standards were taken into account. In the module on Information Resources, ACRL standards (Standard 1,2,34), in the module on Dewey Classification System and LC Classification System, Big6 Information Literacy Model and SCONUL Seven Pillars of Information Literacy Model, in the module on Information Retrieval and Information Search, ACRL standards (Standars 1,2,3,4) and ANZIIL information literacy standards, in the module on Academic Honesty and Ethics, ACRL Standard 5, in the module on APA Citation Styles and Information Verification and Verification Tools, ACRL standards were based upon. 43 students were included in the study. While revealing the effect of the gamification-enriched IL program on students'

performance, a group that had not previously attended an IL course was selected to measure and determine accurately. In this context, the factors that would affect the results of the experimental study were eliminated. In this perspective, students of a different discipline were preferred to be included as control and experimental groups.

The control group attended only IL sessions carried out with conventional methods, on the other hand, the experimental group attended gamification-enriched hybrid IL instruction. During the gamification-enriched hybrid IL instruction, students were asked to play SARLOT in Library IL game[2], which was a digital game aiming to provide the students with IL skills and developed within the frame of this study.After playing the game, students of the experimental group were asked to watch the animation videos designed for seven topics (Information Resources, Dewey Decimal Classification System, LC Classification System, Information Retrieval and Information Search Strategies, Academic Ethics and Honesty, APA 6 Citation Format, Information Verification, and Verification Tools). Second grade students were divided into experimental and control groups.

Problem of the Research and Research Questions

In line with the purpose of the research, the main research question was formulated as "What is the effect of the gamification-enriched IL hybrid education program and learning environment on student academic performance and learning behavior?" Depending on this question, the following sub-questions will be answered:

The primary research questions are formulated as follows:

- What is the effect of the gamification-enriched hybrid IL course on the academic performance level of the second grade students of the Department of Management Information Systems, Ankara Yıldırım Beyazıt University?
- What is the effect of the traditional IL course on the academic performance of the second grade students of Ankara Yıldırım Beyazıt University Management Information Systems Department?

Questions about the pre-test and post-test:

- Is there a statistically significant difference between the pre-test results of the control and experimental groups?
- Is there a statistically significant difference between the post-test results of the control and experimental groups?
- Is there a statistically significant difference between the pre-test and post-test results of the control and experimental groups in all modules?

Within this perspective, the main hypothesis of the research was formulated as "Gamification-enriched IL hybrid education positively affects the performance level of students." The sub-hypotheses related to this are as follows:

- Gamification-enriched IL hybrid education has a positive effect on the success of the second grade students of Department of Management Information Systems Ankara Yıldırım Beyazıt University.

[2] It was a digital Escape Room game specially designed within the frame of this study. In the design phase of the game, the study by Guo and Goh (2016) was based upon. The game has been developed as a seven-level escape room. The first level is on Information Resources; the second level is on the Dewey Decimal Classification System; third part handles LC (American Congress Library Classification System) Classification System; fourth part is Information Retrieval and Information Search Strategies; the fifth chapter deals with Academic Ethics and Honesty, the sixth chapter deals with APA 6 Citation Format, and the seventh chapter deals with Information Verification and Information Verification Tools)

- There is not a significant difference between the pre-test results of the control and experimental groups.
- There is a significant difference between the post-test results of the control and experimental groups.
- There is a significant difference between the pre-test and post-test results of the control and experimental groups across all modules.

Research Method, Data Collection Tools and Assessment Techniques

In this study, qualitative and quantitative methods were applied together. The study was designed as a mixed method research. The mixed method is the use, collection and analysis of qualitative and quantitative methods together in the research process (Creswell and Plano Clark, 2011 p. 254, 406; Bowers et al., 2013, p. 2158). In the quantitative context, the descriptive method and the experimental method were used collaboratively. Within the framework of the descriptive method, the survey was applied to collect data. The questionnaire is defined as "an object or group giving information about itself through pen and paper (Kaptan, 1998, p. 138). In the scope of experimental method, quasi-experimental design was used.

The quasi-experimental design is a design that is widely used in educational studies, in which a training program is applied, the pre-test is implemented before the program, the pre-knowledge of the participants is measured. Following the implementation of the targeted program, the post-test is applied to determine the effect of the program on the target audience, and the results of the pre-test and post-test are compared (Thyer , 2012). A semi-structured interview technique was used for the qualitative method. A semi-structured interview is an interview technique in which some of the questions to be asked to the target audience are prepared in advance, and some of them are shaped during the interview. (Adams, 2015, p. 494). The use of the mixed method within the scope of the research will contribute to cross-checking the findings obtained by qualitative and quantitative methods and determine whether they support each other.The research design of this study is consistent with other studies in the literature (Gumulak and Webber, 2011; McDaniel, Lindgren, & Friskics, 2012; Mekler et al, 2013; Marcos et al, 2014; Banfield and Wilkerson, 2014; Mesko and Györffy, 2015; Boskic and Hu, 2015; Strmecki, Bernik and Rodosevic, 2015; Terrell, 2016; Cahyani, 2016; Poodej ve Lerdpornkulrat, 2016; Machajewski, 2017; Sailer et al., 2017). This research design has three important pillars. The first of these is the Preparation and Design Phase. The second is the Semi-experimental Implementation Phase, and the third is the Evaluation Phase. This study was approved with the decision of the Hacettepe University Ethical Board on 27 October 2020 dated meeting of Hacettepe University Senate.

Before the quasi-experimental application, a pre-test was applied to determine the pre-knowledge level of both groups about the course topic. Following the pre-tests process started. Training of the control and experimental group continued for 13 weeks. After the training, a post-test was applied to determine the effect of gamification-enriched IL instruction on student achievement. Pre-test and post-test questions are the same. The post-test and pre-test include questions related to the topics aimed to be taught in gamified practice and traditional education. The analysis of the data collected from the related questionnaires was carried out with the SPSS Statistical 23 Program. After the application, the Dependent Two-Sample t-Test was performed in order to find out the difference between the post-test results of the participants. Before the application, the Dependent Two-Sample t-Test was applied to find out the difference between the pre-test results of the participants.

Findings

Evaluation of Student Achievement

In this section, pre-test and post-test academic performance were assessed in order to determine the difference between the academic performances of the experimental and control groups before and after the training. In the first stage, the overall academic performance level was examined according to the groups.

In this context, the total scores of the experimental and control groups from all modules were compared. Secondly, the achievement levels according to the modules were examined. The scores of the experimental and control groups from each module were discussed. It was examined whether there was any change in the knowledge levels of the experimental group after the hybrid training enriched with gamification and the control group after the traditional training.

Achievement According to the Groups

In order to determine the effect of gamified IL education on students' academic performance, the total scores of the students from the pre-test applied before the training and the post-test applied after the training were evaluated according to the experimental and control groups. Before the training, it was expected that the pre-test results of the control and experimental groups would be similar, and there would not be a big difference between them. It is important that students' prior knowledge levels on the subject are close to each other in order to evaluate a change (increase or decrease in academic achievement) that can be seen in the scores after the post-test application, depending on the training received. Total points were obtained by adding the points students got from their answers to 60 questions. The highest score a student can get is 60. The results of the experimental and control group students from the pre-test were compared.

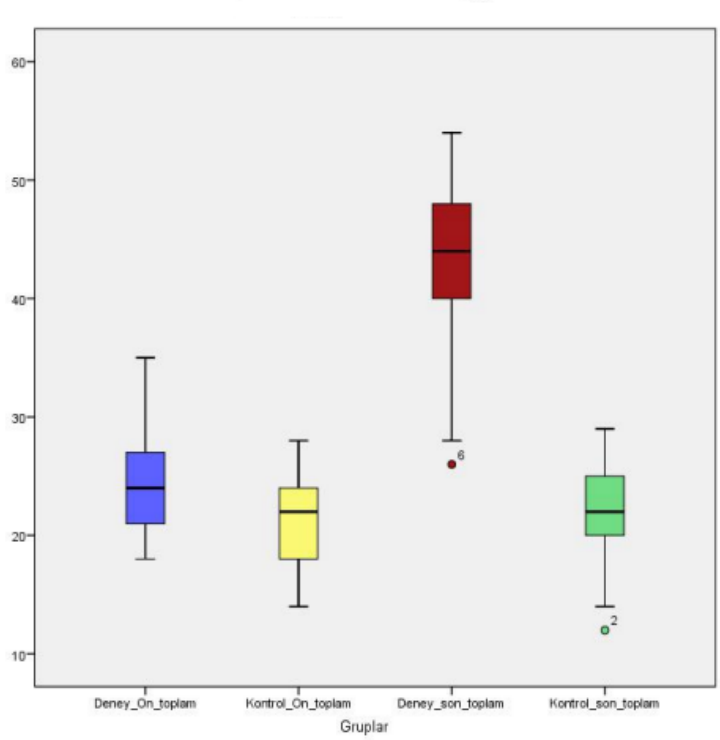

Figure 1[3] :Distribution of Students' Pre- and Post-Test Total Scores

The scores of the students in the experimental group from the pre-test vary between 18 and 35 (dg=17, sd=5.07). The average score of the students in this group from the pre-test was determined as 24.57($\bar{x}$). The lowest score the students in the control group got from the pre-test was 14, and the highest score was 28

[3] Since the scores of the 6th (min=26) student in the experimental post-test group and the 2nd (min=12) student in the control post-test group were below the score patterns of the other students in their own group, these students were indicated with a separate point on the graph as outliers.

(dg=14, sd=4.27). It was observed that the average score of the students in this group was 21.32 ($\bar{x}$). Although the pre-test scores of the two groups are not the same across the modules, they are close to each other. No statistically significant difference was found between the total pre-test scores of the students in the experimental group and those in the control group from the pre-test (t=2.044, p=0.054).

The lowest score of the experimental group in the post-test was determined as 26, the highest as 54 (dg=28,sd=7.02), and the grade average of the students in this group was 42.57 ($\bar{x}$). According to the results of the Two-Sample Dependent t-Test, a statistically significant difference was found between the pre-test and post-test grade point averages of the experimental group (t =-10.018, p=0.000). Accordingly, it was determined that the test scores of the experimental group students increased significantly after the hybrid education enriched with gamification. In this scope, it is possible to say that IL education enriched with gamification positively affects student achievement and increases student academic performance.

The scores of the control group in the post-test ranged from 12 to 29 (dg=17,sd=4.46), and the mean score was 22.41 ($\bar{x}$). A statistically significant difference was found between the post-test score of the experimental group and the post-test score of the control group (t=12.676, p=0.000). It was determined that there was no statistically significant difference between the pre-test and post-test results of the control group (t=-0.787, p=0.440). It is a remarkable finding that there was no increase in the success level of the control group after the training. This is an unexpected situation within the scope of research. It is thought that this situation may be due to many reasons related to the way traditional IL instruction is applied as can be understood from the feedback given. Students stated that they did not find the presentations impressive. In addition, the findings also point to a lack of practice. In addition, the examples used while teaching the subjects may be insufficient in terms of revealing the scope of the subject and learning outcomes [4] or the examples chosen by the researcher may not be suitable for the context of the subject. Plans for the tutorial instruction of both groups were made before the COVID-19 pandemic. Within the scope of traditional training methods, practical activities were planned for the control group's training. However, with the emergence of the COVID-19 pandemic, the planned face-to-face training was implemented online. In cases such as when students could not attend the online training session, the session was repeated by the researcher for the students who could not take part previously. Additional evaluation sessions were carried out with researchers to increase the efficiency of the training. Performance-based activities[5] may not have been highlighted sufficiently during the online training. On the other hand, from the point of view of multiple intelligences theory, traditional educational materials may not have addressed some intelligence types. The designed traditional learning setting may have been insufficient in terms of creating an individual learning environment for students and offering personalized features. All these possibilities are among the factors that have the potential to negatively affect the effectiveness of traditional IL instruction.

Achievement According to Modules

In order to reveal in which module the students were more successful or unsuccessful, which module improved the knowledge level of the students more, or whether it had any effect on the knowledge level; the prior knowledge level of the students in the experimental and control groups before the training of each module was compared with the post- knowledge level after the training. In this context, the mean scores of the experimental and control group students from the pre-test and post-test applied for each module were compared. In order to test whether there is a statistical difference between the academic performance level of the groups, the Two Sample Dependent t-Test was applied. There are 60 pre-test and post-test questions in total. There are ten questions in the following modules: First Module (Information Sources), Fourth (Information Retrieval and Information Search Strategies), Fifth (Academic Honesty and Ethics), Sixth

[4] The learning outcomes of the IL instruction modules are given in detail in the table given in the Annex-I.

[5] Performance-based activities include the educational activities and exercises aiming to apply the practical knowledge gained throughout the IL instruction. For instance, in the gamified activities, students carried out the given tasks in the digital IL game called as “Charlotte on Duty in the Library” developed within the frame of this study.

(APA 6 Citation Formats), and Seventh (Information Verification and Verification Tools) The maximum score a student can get from these modules is "10". There are 10 questions under the title of Library Classification Systems, five questions each belonging to the second (Dewey Decimal Classification System) and third module (LC Classification System), and the questions belonging to these two modules were assessed together. The questions in the test are grouped under six headings. A student can get the highest 10 points from the questions of the second (5 points) and third module (5 points). The pre-test results were examined to determine whether the experimental and control groups' prior knowledge levels on the topics covered in the module were close. Post-test results were also examined to evaluate their post-training status. Two-Sample Dependent t-test was applied to determine whether there was a statistically significant difference between the pre-test and post-test mean scores of both groups. According to the Two-Sample Dependent t-Test, no statistically significant difference was found between the pre-test averages of the groups (t=1,504). A significant difference was found between the scores of the groups in the post-test (t=12.676, p=0.000).

Analysis of the First Module on Information Resources

In the first question, which asked students to choose the correct statement among the given statements about library catalogs, reference sources, databases and almanacs, the experimental group's academic performance level was found out to be approximately 60%, which was evaluated as positive in terms of the effectiveness and efficiency of the gamified IL program. In the second question, which aimed to determine the students' knowledge level about atlases, magazines, scientific journals, newspapers, periodicals and almanacs, an increase of %30 was observed in the academic performance of the experimental group following the gamified training. Similarly, when compared to the pre-test performance, an increase of approximately 23% was observed after the traditional IL training. In the third question, students were asked to identify information resources and determine whether they were reference sources. After the IL training, the experimental group showed an improvement of nearly 40%, while the control group's knowledge level increased by approximately 20%. The fourth question includes propositions about scientific journals and magazines. In this question, a decline of 50% in the academic performance of the control group is striking. In the fifth question, students were asked to identify information resources and determine which source was a periodical among the given options. However, it is noteworthy that the experimental group's pre-test score was already high for this question.

The approximately 20% decline in the academic performance of the control group indicates that students were unable to acquire this knowledge through traditional IL training. This may be related to the training process itself or other underlying factors. In the sixth question, students were asked to distinguish between primary and secondary sources, using examples such as a critique of William Shakespeare's A Midsummer Night's Dream, The Hospital Administrator's Handbook, and an interview with Tesla CEO Elon Musk about his new project on the TV program The Joe Rogan Experience in the USA. Regarding this question, there was a significant improvement in the success rate of the experimental group after the gamified IL training. In the seventh question, students were asked to determine whether various information sources—such as newspaper articles written by media organizations about Gülse Birsel's speech at Boğaziçi University's 100th graduation ceremony, news about the atomic bomb dropped on Hiroshima in 1949, a legal report proposing revisions to the Turkish Code of Obligations, and a Wikipedia article about the Turkish War of Independence—were primary or secondary sources. It was found that the increase in the pre-test and post-test success rates of the experimental group was below 10%, while it is surprising that the difference in the control group after the traditional training was around 20%. When the differences between the pre-test and post-test success rates of the groups were examined in this module, academic progress was observed in the control group following the training. In the eighth question, students were asked to classify various sources—such as a newspaper article about Emine Bulut's murder, Mine Urgan's book A Dinosaur's Memories, the proceedings book of the European IL Conference, a short essay introducing Greek cuisine, and old movie tickets—as either primary or secondary sources. In question nine, students were also asked to identify the resources (such as Wikipedia, the Game of Thrones review written by Business Insider, the

interview of Game of Thrones actress Sophie Turner about the film, and David R. Williams' TEDX speech "How racism makes us sick?") as primary or secondary resources. Based upon the findings, it it is possible to mention that gamified IL training dramatically increased the academic performance of the experimental group. On the other hand, it is difficult to make a such comment in favor of the control group in terms of the effectiveness of traditional training. The results are clearly in favor of the experimental group in the tenth question, students were asked to carry out the same task as well. They were asked to identify the resources such as Ahmet Hamdi Tanpınar's novel entitled as Yaşadığım Gibi, Edebiyat Ders Notu's Youtube channel's video on Ahmet Hamdi Tanpınar's novel Huzur summary, Canan Tan's book entitled as Yüreğim Seni Çok Sevdi and Elif Mahir Metinsoy's book entitled as Dünya Müzesi, and the technical report published by NASA on rockets launched into space.

The scores of the students in the experimental group in the questions of the first module (Information Resources) in the pre-test vary between 1 and 8 (dg=7, sd=1.83). It is seen that the pre-test mean score of the experimental group was 4.42 ($\bar{x}$). It was observed that the lowest and highest scores of the students in the control group from module 1 were 1 and 6 (dg=5; sd=1.53). The mean score for the pre-test was calculated as 3.45 ($\bar{x}$). In the Two-Sample Dependent t-Test, it was determined that the prior knowledge levels of both groups were close to each other (t=1,630). It was determined that the scores of the students in the experimental group from the post-test ranged between 2 and 9 (dg=7, sd=2.08) and the average score was calculated as 7.47 ($\bar{x}$). After the hybrid training enriched with gamification, positive progress was made in the success level of the experimental group. It was determined that the increase in the scores of the experimental group between the pre-test and post-test was statistically significant (t=-4.954, p=0.000). The difference between the post-test scores of the experimental group and the control group was also proven statistically significant (t=5,796, p=0.000). It was determined that the post-test scores of the control group were between 0-8 (dg=8, sd=2.01) and the mean score was 4. According to the Two-Sample Dependent t-Test applied, no significant increase was observed between the scores of the control group before and after the traditional education (t=-1.101, p=0.283).

Second and Third Module on Dewey Decimal Classification System and LC Classification System.

In the first question on the Dewey Decimal Classification System, 67% of the 21 students in the experimental group and 45% of the students in the control group answered correctly. After the traditional IL training, the number of correct responses in the control group remained unchanged, whereas the percentage of students in the experimental group who received gamified IL instruction and answered correctly increased by 19%. In the second question, which focused on how numerical values assist in classifying books in the Dewey Decimal Classification System, the percentage of students who answered correctly in the experimental group increased by 33.4%, while the increase in the control group was 18.2%. In the third question, which focused on the characteristics of the Dewey Decimal Classification System, only about 38.1% of the students answered correctly in the pre-test. However, this rate increased to 70% in the post-test, indicating a significant rise in the number of successful students. Compared to the experimental group, it is noteworthy that although the percentage of students who answered this question correctly in the pre-test was lower in the control group (22.7%), the number of correct responses increased in the post-test. Despite this improvement, the overall success rate of the control group remained lower than that of the experimental group. In the pre-test for Question 4, which focused on the purposes of library classification systems, the success rates of the experimental (71.4%) and control (68.2%) groups were relatively close. However, a significant difference emerged between the success rates in the post-test. The 23.8% increase observed in the experimental group is considered a positive indicator of students' academic success due to the gamified IL instruction. However, while a significant increase in the success rates of the control group was not expected following traditional IL instruction, the decline in the number of students who answered correctly in the control group was an unexpected result. This suggests that the topic may have been inadequately covered during the IL instruction delivered through traditional teaching methods. In the fifth question on the LC classification system, the post-test performance of the experimental group showed a significant increase, while the control group demonstrated less progress. The pre-test results indicate that

the success rates of both the experimental and control groups were similar. However, in the post-test, the difference between the success rates of the two groups became significant, with the experimental group achieving 95.2% and the control group 45.5%. In the sixth question, which focused on identifying false statements about the Dewey Decimal Classification System and the LC Classification System, the success rate of the experimental group increased by 38% between the pre-test and post-test. Similarly, in the seventh question about library classification systems, a 42% increase in the experimental group's success rate highlights a significant improvement in their academic performance. Considering the 12% difference in the pre-test and post-test success levels of the experimental group in this question, it can be said that traditional IL instruction is at least partially effective. When the correct answers given to the questions are evaluated, it is seen that the in the sixth and ninth questions in the pre-test and in sixth and eighth questions in the post-test, the experimental group got the least correct answers. The control group also made mistakes in questions third, sixth, seventh and eighth in the pre-test, and in the sixth, seventh and eighth questions in the post-test. When this module is evaluated in general, it is seen that there is no change in the academic performance of the control group in questions 1 and 8, and there is a decline in questions 4 and 6. In line with the findings, it is shown that the gamified IL instruction on the Dewey Decimal Classification System and LC Classification Systems positively affects the learning behaviors of the students and reinforces their knowledge.

The lowest pre-test score of the experimental group for the second and third modules (Dewey Decimal Classification System and LC Classification System) was 1 and the highest score was 6 (dg=5, sd=1.48). It was determined that the mean score of this group was 4.23 ($\bar{x}$). The students in the control group, on the other hand, got the lowest 1 and the highest 7 points from the answers they gave to the questions about these modules (dg=6; sd=1,39) and their average score was 3.54 ($\bar{x}$). The findings reveal that there is no statistically significant difference between the pre-test scores of the experimental and control groups (t=1.404, p=0.176). The scores of the experimental group from the post-test vary between 4 and 10 (dg=6, sd=1.77). Grade point averages increased to 7.57 ($\bar{x}$). After the hybrid training enriched with gamification on library classification systems, a remarkable increase was observed in the post-test average of the experimental group. It was concluded that the difference between the pre-test and post-test mean scores of the experimental group was statistically significant (t =-5.680, p=0.000).

Based on the findings, it is possible to say that there has been an improvement in performance in education given hybrid methods enriched with gamification in the Dewey Decimal Classification System and LC Classification System. It is thought that the educational environment supported by games and animation videos offers students the opportunity to repeat and reinforce their knowledge. The scores of the students in the control group from the post-test were in the range of 0-8 (dg=8, sd=2.01) and the mean score was determined to be 4.45. Although there was a slight increase in the scores of the control group after the traditional education compared to before, it is observed as a result of the Two-Sample Dependent t-Test that this increase is not statistically significant. In this module, it can be understood the training might have some deficiencies and lacking components for the control group (t=-1.664, p=0.111). It is understood that in traditional IL instruction, more practical activities that will enable students to comprehend the subject should be given more space. The difference between the post-test scores of the experimental group and the control group was statistically significant (t=4.863, p=0.000).

Analysis of the Fourth Module on Information Retrieval and Information Search Strategies

In the first question focusing on the use of keywords, author names and study titles to access an information source indexed in the database, there was a 50% improvement in the experimental group's academic performance. In the second question, which addressed keywords and search tools, the improvement level of the experimental group was around 20%. One of the striking findings in this question was the difference between the prior knowledge levels of the two groups. In the third question, the students were asked to identify the incorrect statements given related to the search in the EBSCOhost database. The difference between the post-test success scores of the two groups, which did not have a very large difference in their prior knowledge levels, was striking. Although a significant positive improvement was not expected

between the pre- and post-test scores of the control group, regression of 20% was also found surprising. When the academic performance level of the two groups is examined in the fourth question, which is about narrowing down the search results with the conjunction "and" written in the search field, the academic performance level of the experimental group was found out higher. The findings are similar to the previous question. In the fifth question, which includes the use of prepositions while making a research in databases and library catalogs, an increase of 20% in the number of the successful students, while the increase in the control group is less. In the sixth question, which deals with Boolean operators, all students in the experimental group answered the question correctly in the post-test. The next question is about information search strategies. Although it increases in the academic performance level of the control group in this question is greater than in the experimental group, the change between the pre-test and post-test scores of the control group is not distinctive. In the 8th question, which deals with prepositions about filter bubbles, it is observed that there is a small increase in the academic performance level of both groups. In the following two questions, the change observed in the academic performance level of the experimental group following the instruction was higher. While a significant increase was expected in the experimental group after the gamified IL training, a decrease in the academic performance rate of the control group was not an expected finding.

Similar to the other modules, in the questions of the fourth module (Information Retrieval and Information Search Strategies), it is seen that the increase in the scores of the experimental group students between the pre-test and the post-test is quite evident, but there is no significant difference between the pre-test and post-test of the control group. The score distribution of the students in the experimental group from the answers they gave in the pre-test for the fourth module ranged from 1 to 7. The mean of the responses of the group (dg=6, sd=1.36) was 3.47($\bar{x}$). The pre-test score distributions of the control group ranged between 0-6 (dg=6, sd=1.58) and their average score was calculated as 2.90 ($\bar{x}$).There was no statistically significant difference between the prior knowledge levels of the two groups (t=1.033, p=0.314). While the post-test responses of the students in the experimental group were between 4 and 10 (dg=6, sd=1.55), the mean score was 6.66 ($\bar{x}$). There was a significant increase between the pre-test and post-test after the training for the experimental group (t=-7.167, p=0.000). The scores of the control group from the post-test were between 0-6 (dg=6, sd=1.57) and the average was 2.77. Although the decrease experienced here is one of the unexpected findings within the scope of the research, it suggests different possibilities regarding the disruptive aspects of education. In this context, it can be said that the applied activities carried out by the researcher with the control group are not sufficient. According to the responses of the control group in this section, while no significant difference was found between the pre-test and post-test (t=0.292, p=0.773), a statistically significant difference was found between the post-test scores of the experimental and control groups (t=9.191, p=0.000) . The findings reveal that after the hybrid IL training enriched with gamification, the students in the experimental group experienced an increase in their academic performance regarding this module.

Analysis of the Fifth Module on Academic Honesty and Ethics

When considering the first question about the ethical dimension in the jointly prepared group assignments, the similarity between the pre- and post-test results of the experimental and control groups is striking. While there was no significant change in the post-test results of the experimental group, the considerable regression observed in the control group was surprising. In the pre-test application of the second question, which examines cases related to academic ethics rules in terms of academic dishonesty, the results of the groups appear to be significantly different from each other. While the number of successful students in the experimental group increased by 28%, the control group showed a 20% increase. For this question, it can be stated that the learning outcome was partially achieved by the students in the control group. In the third question, which assessed the use of a work that is not under copyright, no change was observed in the percentage of students who provided correct answers in the control group. However, the experimental group showed an increase of nearly 25% in the pre-test results. In the fourth question, which examined the conditions for the ethical use of Paul Cézanne's painting in an art assignment, the significant

difference between the post-test results of the experimental and control groups—despite their similar pre-test scores—demonstrates the effectiveness of hybrid methods supported by gamification.In the fifth question, which involved cases related to academic ethics rules, the impact of gamified education is demonstrated by the 50% increase in the success rate of students in the post-test application of the experimental group. Additionally, the nearly 50% difference in the success rates between the experimental and control groups in the post-test further highlights this effect. While no change occurred in the control group in the 6th question, which included learning outcomes related to academic ethics rules related to articles, master's thesis and exams, an improvement was observed in the academic performance of the experimental group after the gamified education. Similarly, in the seventh and ninth questions, where sample cases on academic ethics are given, it is striking that there is a greater improvement in the post-test results of the experimental group compared to the control group. One of the most notable findings in the seventh question is the 20% increase observed in the control group. Similarly, the improvement seen in the experimental When the questions in this module are evaluated as a whole, the results appear to favor the experimental group. While the pre-test and post-test success rates of the control group remained stable in the third and fourth questions, a decline in performance was observed in the first, fifth, sixth, and eighth questions.group in the eighth question, which follows a similar question format, aligns with the expected results.

While the pre-test score range of the experimental group was 2-9 (dg=7, sd=1.76) in the fifth module, the post-test score range changed positively to 5-10 (dg=5, sd=1.59). The mean score of the experimental group, which was 5.71 ($\bar{x}$) in the pre-test, increased to 7.6 ($\bar{x}$) in the post-test applied after the hybrid education enriched with gamification. A significant increase was observed between the pre-test and post-test averages of the experimental group students with the t-test (t=-7.176, p=0.00). On the other hand, it is striking that there was no significant increase in the academic performance of the students in the control group. The pre-test score range (lowest and highest score) from 2-7 (dg=5, sd=1.35) changed to 3-9 (dg=6, sd=1.53) in the post-test. The mean score, which was 4.72 ($\bar{x}$) in the pre-test, increased to 4.95 ($\bar{x}$) after the training applied with traditional methods, but the difference between the pre-test and post-test scores was not statistically significant (t=-0.554, p=0.586). While there was no significant difference (t=1876, p=0.075) between the pre-test results of the experimental and control groups, there was a statistically significant difference between the post-test results (t=7,310, p=0.000). It is observed that there is no significant improvement in the performance of the control group on the basis of this module.

Analysis of the Sixth Module on APA 6 Citation

In the first question, which is on scientific article citation, a difference was observed between the knowledge levels of the experimental and control groups—despite their initially similar prior knowledge—after the training they attended. While students in the experimental group demonstrated increased competence in scientific article citation, no significant change was observed in the control group's awareness of the subject. In the pre-test for the second question, which asked students to identify the incorrect example according to the APA 6 citation style, it was observed that the majority of students in both the experimental group (9.5%) and the control group (9.1%) answered incorrectly. There was no significant change in the academic performance level of the control group after the traditional IL instruction. Although the percentage of students in the experimental group who answered the question correctly in the post-test was not high (61.9%), the 50% increase in correct responses compared to the pre-test is considered a positive indicator of the effectiveness of the gamified training." In the third question, which included examples of book references, an analysis of the control group's data reveals that the information conveyed through traditional teaching methods is not highly retained by students."An analysis of the data from the fourth question, which addresses the learning outcome for edited books, shows that the progress rate in the experimental group (4.8%) is relatively low. Although it is surprising that the number of correct answers in the control group increased by nearly 20%, this raises the question of whether certain information and topics may not be well-suited for gamification. Additionally, the reasons behind the significant improvement in the performance of the experimental group students remain open to discussion. The findings of this question indicate that during

the gamified IL instruction, 50% of the students in the experimental group learned how to cite an edited book, once again demonstrating the effectiveness of the gamified IL instruction. However, the varying performance levels of the experimental group in two separate questions (fourth and fifth), which focus on the same learning outcome but do not overlap, are thought-provoking and intriguing.This situation may have arisen due to the way the question was formulated, a lack of clarity in students' understanding, or the possibility that students in the experimental group did not develop sufficient awareness of acquiring this information—perhaps due to the ineffectiveness of certain aspects of the gamified training. Another unexpected finding in this question is that the percentage of students in the control group who answered correctly increased by 20%. The decline in the post-test academic performance of the control group in sixth question, which focuses on referencing a book chapter in an edited book, suggests that traditional teaching methods may not be effective for every subject. On the other hand, considering the 20% improvement observed in the experimental group, it can be said that the training provided was beneficial in teaching the learning outcome of this question.It is noteworthy that there was no significant change between the pre-test and post-test scores of both groups in seventh question which is similar to fourth and fifth questions. In the pre- and post-tests, three questions (four, six and seven) focused on how to cite an edited book. The lack of a significant difference in the post-test results of the experimental group for fourth and seventh question suggests that certain topics or subjects may not be well-suited for gamified learning designs. The academic performance increases in the rate of approximately 30% and 20% in eighth and ninth questions, which focus on citing a scientific journal and a printed book, respectively, further highlight the advantage of the experimental group. Additionally, the decline in performance observed in the control group for sixth, eighth and tenth questions along with the lack of significant progress in question 9, suggests that traditional education may not always have a positive impact on academic success. The findings indicate that some questions in the APA 6 Citation Styles section yielded unexpected results and that both the experimental and control groups demonstrated surprising success rates in certain questions. Although this module is one of the two with the lowest average success rate for the experimental group (6.14) among all modules, the overall success rate was still higher than that of the control group. In other words, when evaluating the questions in this module as a whole, it can be concluded that the experimental group demonstrated better academic performance after the gamified training compared to the pre-test results. Another finding suggests that presenting certain information using gamified methods may have a similar effect to traditional teaching methods.

Similar to the previous modules, an increase was observed in the scores of the experimental group from the test administered after the training in the sixth section, and it was determined that there was no significant difference between the pre-test and post-test of the control group. While the scores of the students in the experimental group from the questions of the sixth module (APA 6 Citation Format) in the pre-test ranged between 1 and 7 (dg=6, s=1.69), the mean score of the group was calculated as 3.19 ($\bar{x}$). In the control group, while the answers were between 1 and 6 (dg=5, sd=1.40), their average score was calculated as 3.22 ($\bar{x}$). There was no statistically significant difference between the pre-test scores of the two groups (t=0.000, p=1.000). The scores of the experimental group students from the post-test in this section vary between 3in minimum and 9 in maximum (dg=6, sd=1.76). After the hybrid training enriched with gamification on the APA 6 Citation Format, there was a remarkable increase in the post-test average score, and the score rose to 6.14 ($\bar{x}$).. As a result of the Two-Sample Dependent t-Test, it was determined that the increase observed between the pre- and post-tests of the experimental group was at a statistically significant level (t=6.660, p=0.000). While the scores of the control group in the post-test were 0 as the lowest and 6 as the highest, the mean score was 3.31 ($\bar{x}$) (dg=6, sd=1.83). According to the Two-Sample Dependent t-Test, there was no significant difference between the pre-test and post-test of the control group students (t=-0.209, p=0.837). The findings support that the APA6 citation given by the traditional method is not very effective. The examples given during the lecture may be insufficient. The lack of academic performance-based activities may have reduced the efficiency of the course. It is understood that the learning outcomes discussed within the scope of the subject do not reach the student sufficiently. The difference between the groups in the post-test was also proven in the Two-Sample Dependent t-Test (t=4.402, p=0.000).

Analysis of the Seventh Module on Verification of Information and Information Verification Tools

In the first question, which aimed to assess knowledge levels regarding visual verification tools such as Wolfram Alpha, JPEGSnoop, and PhotoForensics, it was found that the experimental group showed a significant improvement, with a nearly 50% increase in the success rate between the pre-test and post-test, while the control group experienced an approximate 10% decline. In the second question, which asked which tool could be used to verify fake news about the toy manufacturer Lego, the experimental group demonstrated a 28% increase in success following the gamified IL instruction. For the control group, this difference was approximately 5%. A similar trend was observed in the third question, which focused on the Free-OCR.com visual and location verification tool, where the experimental group showed improvement, while the control group's performance declined rather than remaining constant. In the fourth, fifth and sixth questions—addressing different learning outcomes in a forensic case, including the verification of weather data, detection of image manipulation, and location verification—the percentage of successful students in the experimental group increased by 28%, 14%, and 28%, respectively. The lack of progress in the control group's academic performance on the fourth and fifth questions, along with no change in their academic performance on the sixth question after the training, suggests that these knowledge and skills were not effectively conveyed to the control group during the traditional IL instruction. In this module, one of the questions where the experimental group did not show improvement in the post-test was the 7th question, which focused on verifying the location of an image. The answer options for this question included Wikimapia, Google Maps, Free-OCR.com, and Snopes.com. It is possible that students were familiar with Wikimapia and Google Maps but had difficulty in differentiating the functions of Free-OCR.com and Snopes.com. In the eighth question, which focused on verifying images uploaded to social media, both the control and experimental groups initially demonstrated similar levels of prior knowledge. However, while the academic performance of the experimental group that attended gamified IL instruction increased by nearly 40%, the improvement in the control group was not significant."In the ninth question, which focused on the Snopes verification site, a significant improvement was observed in the knowledge level of the experimental group, while a decline was noted in the control group. This raises the possibility that the traditional IL instrucion caused confusion among the control group and that the information provided was not retained. The following question pertains to verifying the source of a photo.

In the seventh module (Verification of Information and Information Verification Tools, the pre-test mean scores of the experimental and control groups (experimental= 3.52; control=3.45) were close to each other (respectively, 6.7), and the pre-test score intervals (1- 8) is the same (experimental group sd=1.43; control group sd=1.74). Based on this, it is possible to say that the students' prior knowledge levels on the subject are similar. Two-Sample Dependent t-Test results also support this finding (t=0.108, p=0.915). However, after the training application, a significant difference was observed between the post-test averages of the groups in favor of the experimental group (t=-6.660, p=0.000). The minimum score of the experimental group increased to 3 and the maximum score to 9 (dg=6, n=1.27). The mean score was calculated as 6.14 ($\bar{x}$). The result of the Two-Sample-Dependent t-Test also reveals that the increase in the academic achievement of the experimental group after the hybrid training enriched with gamification is statistically significant and shows a significant improvement in academic performance (t=-6.660, p=0.000). In the control group, whose post-test score range was 0-7 (dg=7, sd=1.88) and the mean score was 2.90 ($\bar{x}$), it was observed that the knowledge level of the students decreased after traditional education. There is a statistically significant difference between the post-test scores of both groups (t=8,271, p=0.000). The Two Dependent Sample t-Test also reveals that there is no significant difference between the pre- and post-test mean scores for the control group (t=1,226, p= 0.234). Although a high increase in the academic performance of the control group after the traditional education is not expected, it is unexpected that the academic performance level shows a slight decrease (See Table 1).

It is understood that the effectiveness of the IL education for the seventh module is at a low level, and the learning needs of the students were not adequately fulfilled. It is thought that some information about the features and functions of verification tools is not adequately conveyed to the students. In addition, the important points of the subject may not have been emphasized enough in the question-answer technique

used during the training. The examples presented in cases aimed at reinforcing the subject may not have been processed in an explanatory way. Validation tools are an issue that requires practice. Verifications were made using these technical tools while performing traditional lectures, and examples in different cases and scenarios were shown. Verification techniques were tried to be instructed to the students through examples. However, the inability to perform one-to-one repetitive practices in the computer laboratory may have caused the information to be taught to the control group students at a limited level.

Table 1. Academic Performance Distribution of Experimental and Control Groups According to the Modules

Pre-test and Post-test distribution of the experimental group

	Pre-test distributions				Post-test distributions			
Module No	dg	Highest-Lowest Value	x̄	ss	dg	Highest-Lowest Value	x̄	ss
1	7	1-8	4,42	1,83	7	2-9	7,47	2,08
2-3	5	1-6	4,23	1,48	6	4-10	7,57	1,77
4	6	1-7	6,6	1,58	6	4-10	6,66	1,55
5	7	2-9	5,71	1,76	5	5-10	7,6	1,59
6	6	1-7	3,19	1,69	6	3-9	6,14	1,76
7	7	1-8	3,52	1,43	6	3-9	6,14	1,27

Pre-test and Post-test distribution of the experimental group

	Pre-test distributions				Post-test distributions			
Module No	dg	Highest-Lowest Value	x̄	ss	dg	Highest-Lowest Value	x̄	ss
1	5	1-6	3,45	1,53	8	0-8	4	2,01
2-3	6	1-7	3,54	1,39	8	0-8	4,45	2,01
4	6	0-6	2,90	1,58	6	0-6	2,27	1,57
5	5	2-7	4,72	1,35	6	3-9	4,95	1,53
6	5	1-6	3,22	1,40	6	0-6	3,31	1,83
7	7	1-8	3,45	1,74	7	0-7	2,90	1,88

When the academic performance level of the students in the experimental and control groups in the pre- and post-test questions related to the modules is evaluated, it is seen that there was a significant increase in favor of the experimental group in all modules in the post-test. In the control group, there was a decrease in academic performance in the fourth and seventh module post-tests, and it is noteworthy that the increase in academic performance in other modules was very low. The regression seen in these two modules is one of the unexpected findings within the scope of the research. It was predicted that some improvement would occur, although not as much as seen in the experimental group. This situation questions the possibility problems might have occurred in IL instruction and this might not have been recognized by the researcher. The decrease observed in the academic performance of the control group in two modules may be an indicator of the deficiencies in the implementation process of traditional IL education. For example, the practical activities carried out during the training may have been insufficient. The topics may not have been effectively transferred to the students by the researcher. The motivation status of students can be another factor. The findings are also consistent with the evaluations of the students towards traditional education. In this context, it is possible to say that the researcher could not adequately motivate the control group and that the student's loss of interest negatively affected the dynamics of the lesson. Based on the findings, the need for additional activities and more practice is understood in order to effectively convey the important and key points of the subject to the student.

On the other hand, the positive results in favor of the experimental group can be evaluated as findings that draw attention to the importance of hybrid methods enriched with gamification. It is thought that IL education, which is given with hybrid methods enriched with gamification, provides reinforcement in the learning processes of the students in the experimental group and causes a significant increase in their performance. It can be said that the students receive a reinforced education with three different educational

tools: Power Point presentations, animation videos and IL game, allowing them to understand and learn the concepts, knowledge and facts about the subject in depth.

Results and Recommendations

Pre-test and post-test results applied in order to compare the knowledge levels of the students in the experimental and control groups before and after the education were analyzed. In this framework, the general performance status of the groups and their performance in each module and each question were evaluated. Considering the general academic performance status of the experimental and control groups in all modules, it was determined that the academic performance status of the experimental group was slightly higher than the academic performance status of the control group in the pre-test conducted to determine the preliminary knowledge status on the subject. Although it was determined that the prior knowledge levels were not very similar, no statistically significant difference was found between the academic performance status of the two groups. However, it was found out that there was a significant increase in the academic performance of the experimental group after the hybrid training enriched with gamification, but there was no change in the overall academic performance of the control group. In addition, a statistically significant difference was found between the post-test scores of the two groups.

In addition to the general academic performance status, the academic performance status of the students according to the modules was also examined. In this context, the first module (Information Resources), the second and third modules (Dewey Decimal Classification System, LC Classification System), the fourth module (Information Access and Information Search Strategies), the fifth module (Academic Integrity and Ethics), the sixth module (APA 6). The academic performance of the students in the experimental and control groups in the pre- and post-test questions of all modules, including the Citation Format) and the seventh module (Verification of Knowledge and Verification Tools), were examined. It was examined whether there was a statistically significant difference between the pre-test and post-test performances of the two groups.

When the preliminary knowledge level of the groups related to the first module was examined, it was determined that the academic performance status of the experimental group in the pre-test was slightly higher. However, the Two-Sample Dependent t-Test revealed that this difference was not statistically significant, and within this framework, it can be interpreted that the prior knowledge levels of the groups are close to each other. The findings reveal that there was a high increase in the academic performance of the experimental group after the gamification-enriched application, while there was a small increase in the academic performance of the control group after the traditional training. Two-Sample Dependent t-Test also confirmed the significant difference between the post-test scores of the two groups. There was an increase in the academic performance of the experimental group in all the questions of the module. The higher academic performance of the experimental group compared to the control group can be associated with the hybrid education enriched with gamification. It is thought that the low increase in academic performance in the control group is due to the lack of practice on the subject.

Although the academic performance level of the experimental group in the pre-test questions of the second and third modules was somewhat high, this difference was not found out to be statistically significant. After the hybrid training enriched with gamification, it is noteworthy that there is a remarkable improvement in the performance of the experimental group, while the increase in the performance of the control group is observed to be lower. Similar results were obtained in the academic performance distributions of the pre-test and post-test results of the fifth and sixth modules. In the sixth module, the highest increase in performance was achieved in the second and third questions of the experimental group. The results show that the experimental group benefited from the gamification-enriched hybrid IL training.

When the pre-test and post-test questions of the fourth and seventh modules were evaluated, a significant difference was found between the groups in favor of the experimental group, while an unexpected finding was observed in the control group. After the traditional IL training, there was a regression in the academic performance of the control group in the post-test questions of these two modules. While the increase in the knowledge level of the experimental group after the hybrid training enriched with

gamification is one of the expected results, the situation regarding the control group is thought-provoking and although there is not a dramatic increase as seen in the experimental group, it is expected that there will be some increase in the academic performance of the control group. The decline in the academic performance level of the control group can be associated with the possibility of different problems with the way traditional education is delivered and the lack of practical activities. The findings of the control group also coincide with the group's evaluations for education.

Considering the academic performance status of the experimental and control groups across all modules, it is seen that there is a significant improvement in the performance status of the experimental group after the hybrid IL training enriched with gamification. In addition, when the details (mean, standard deviation and distribution width) of the scores of the experimental and control groups were examined across all modules, it was determined that the fifth, second and third modules were the modules that provided the most benefit to the students in the experimental group. The sixth and seventh modules are among the modules that provide the least benefit for the experimental group. In terms of the control group, the fifth, second and third modules are the most beneficial, and the fourth module is the least beneficial. The findings show that gamification-enriched hybrid methods make a positive contribution to students' learning performance and learning behavior. On the other hand, it reveals that traditional IL education should be supported by applied activities. In this context, it is thought that the gamification of the lessons and the blending of the traditional methods used in the lessons with the gamified methods will increase the success of the students in the course.

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Appendix: Learning Outcomes and Objectives of the Modules

Table 1. Distribution of the Modules According to the Topics

Module No	Subjects	General Objectives of the Programme	Targets of the Module	Learning Outcomes of the Module
1	Information Resources	This module aims to equip students with knowledge and skills regarding different types of information sources.	By the end of this module, students will gain knowledge and competence in the types of information sources, their differences, types of information and appropriate sources for each type, information storage mediums, and primary and secondary sources	By the end of this module, students will be able to: -Identify the types and scope of information sources. -Distinguish between different types of information sources. -Select appropriate sources based on their information needs. -Recognize the characteristics of information storage mediums. -Differentiate between primary and secondary sources. -Understand the characteristics of primary and secondary sources.
2-3	Dewey Decimal Classification System and LC Classification System	This module aims to equip students with knowledge and skills regarding library classification systems.	This module aims to: -Provide students with knowledge and skills related to the organization of information. -Teach the purpose and logic of library classification systems. -Equip students with knowledge, skills, and competence in shelf organization and call numbers within a library. -Teach students how to locate materials in the library. -Guide students on how to easily find resources in the library.	By the end of this module, students will: -Understand the importance and functions of library classification systems. -Understand the relationship between shelf organization and call numbers in a library. Be able to locate library resources using catalog records. -Recognize the significance of the letter system in the LC classification system. -Learn the function of the decimal numerical values used in the Dewey Decimal Classification System. -Be able to easily find resources in the library

Module No	Subjects	General Objectives of the Programme	Targets of the Module	Learning Outcomes of the Module
4	Information Retrieval and Information Search Strategies	This module aims to enable students to access information and information sources effectively. Additionally, it focuses on teaching students how to search for information and develop information retrieval strategies. Students will gain knowledge, skills, and competence in searching library catalogs, databases, and search engines	By the end of this module, students will: -Develop the ability to identify their information needs. -Acquire effective search skills tailored to their information needs. -Learn how to narrow down a topic during research. -Gain proficiency in effectively using databases, search engines, and library catalogs. -Learn to apply information search strategies for efficient information retrieval. -Develop knowledge, skills, and competence regarding the scope, functions, characteristics, and limitations of filter bubbles. -Enhance their ability to manage the research process. -Learn the features of both basic and advanced search techniques. -Be able to differentiate between searches conducted on Google, Google Scholar, and academic databases. -Develop the ability to evaluate search results in terms of relevance, quality, and quantity. -Gain skills in formulating strategies for using field-specific catalogs, full-text databases, abstracting, and indexing services."**	By the end of this module, students will be able to: -Identify their information needs. -Conduct searches effectively based on their information needs. -Select appropriate sources according to their information needs. -Search efficiently in databases, library catalogs, and search engines. -Learn how to use Boolean operators for searching. -Choose a research topic, determine relevant keywords, and refine the topic using research questions. -Search the library catalog by author name, title, subject, and journal name. -Limit advanced searches by publication language, publisher, date, and resource type. -Gain knowledge about the purpose and use of databases. -Understand the importance of algorithms in managing big data. -Use search engines that prevent filter bubbles. -Manage the research process effectively. -Conduct both basic and advanced searches during the research process."**

Module No	Subjects	General Objectives of the Programme	Targets of the Module	Learning Outcomes of the Module
5	Academic Honesty and Ethics	This module aims to teach students about scientific ethical principles and plagiarism detection software. Additionally, it seeks to help students understand the importance of originality in scientific research	By the end of the module, students will: -Comprehend the importance of in-text citations. -Understand the difference between citation and quotation. -Learn the function of a bibliography and how to format it. -Gain knowledge and awareness of copyright laws regarding intellectual works. -Develop an understanding of the importance of citing sources. -Recognize the significance of academic honesty and scientific ethics. -Understand that using another author's work, idea, intellectual output, visual, or any other type of material without proper citation is a violation of scientific ethics. -Learn how to share and use information without infringing on others' copyrights.	By the end of the module, students will: -Be able to provide in-text citations. -Adhere to copyright rules for intellectual works. -Be familiar with plagiarism detection software and be able to use it. -Act in accordance with ethical principles when conducting scientific research. -Consider the economic, social, and legal aspects of using information. -Provide both in-text citations and proper references in accordance with citation guidelines. -Evaluate the harm that academic dishonesty causes to science.
6	APA 6 Citation Style	This module aims to provide students with knowledge about APA 6 citation rules	By the end of this module, students will: Learn citation formats and rules. Gain knowledge about intellectual property rights and copyright laws. Develop the ability to distinguish between violation and collaboration.	By the end of this module, students will: Be able to cite different sources according to the APA citation style. Provide in-text citations. Prepare a bibliography in accordance with citation rules. Understand the importance of citing sources in scientific publications.

Module No	Topics	General Objectives of the Programme	Targets of the Module	Learning Outcomes of the Module
7	Information Verification and Verification Tools	This module aims to help students understand the importance of information verification, develop the ability to verify information, and use verification tools effectively.	By the end of this module, students will: -Develop the ability to critically evaluate information. -Learn evaluation criteria such as reliability, accuracy, currency, and objectivity. -Gain skills and competence in identifying the credibility of fake news or unreliable sources. -Gain competency, knowledge and skills to verify and assess the accuracy of information, images, and videos shared on social media and the Internet.	By the end of this module, students will: -Be able to evaluate information. -Be able to verify information. -Perform verification using tools such as location, images, data, and identity verification. -Distinguish between fake and real news. -Verify the accuracy of social media posts, website content, and news articles. -Question the source of information.