Analysis of E-Learning Materials in Pre-Service Teacher Training: In Case of the Mongolian National University of Education (MNUE)

Munkhtuya Lkhagvasuren[1], Myagmargarmaa Chuluunbat[2] [✉],
Nyamsuren Tsendsuren[2], and Badamsuren Batsuuri[2]

[1] Mongolian National University of Education, Administrative division, Ulaanbaatar, Mongolia
[2] Mongolian National University of Education, Informatics Department, Ulaanbaatar, Mongolia
myagmargarmaa@msue.edu.mn

Abstract. The main feature that distinguishes online learning from face-to-face learning is that regardless of space and time, students independently study the course content by accessing, uploading, downloading, and sending comments, participating in discussions and webinars, and viewing text, audio, and video content. In the last 4-5 years, educational institutions at all levels have transformed to online learning from face-to-face learning, and there has been a need to use learning platforms to deliver content and lead independent study of students. Educational institutions use LMS, learning management systems such as Moodle, Google Classroom, and MS Teams, as well as social network tools to deliver online course content, manage lessons, and collaborate. E-learning materials have requirements such as support for the student's independent study and create knowledge, and for the student to be able to interact with the contents. To find out whether the forms of e-learning materials uploaded by Mongolian National University of Education (MNUE) lecturers in LMS correspond to the students' learning style, the form, and structure of e-materials of 59 courses were compiled from the data of LMS, and a survey was conducted from 376 students who studied online courses. As a result of the study, students found that text information, video materials, and e-books are more suitable for independent learning, while the data collected from LMS shows that the majority of e-materials are text and video materials. It is suitable for self-study, but further development of learning materials in multiple versions such as videos, e-books, interactive, etc., without being limited to textual information, is important for independent learning for students with different learning styles.

Keywords: Online learning ·Learning materials ·E-content ·LMS

1 Introduction

The rapid advancement of information technology in recent years has revolutionized the field of education, using the internet and digital platforms to deliver instruction and various educational activities. Various forms of education, including teaching and learning processes, as well as the environment and tools provided to students, have been transformed through the integration of technology, fostering innovative approaches [1]. Consequently, traditional teaching methods have shifted towards e-learning methodologies, altering approaches, content, tools, assessment, environment, and communication in education.

Classroom training involves interaction between the teacher and students, whereas e-learning allows students to engage with course materials and receive instruction without requiring the direct physical presence of teachers, fostering a student-centered learning approach [2]. As a result, because e-learning is typically done without a teacher, it is important to examine concerns such as the support of e-learning resources and their compatibility with learning styles [3].

By objectives 5.2 of the medium-term development plan of the education sector (2021-2030) and the Information Technology Development Program of the Mongolian National University of Education (MNUE), the requirements for e-courses, and the online course regulations, university learning management system (LMS) is being developed and used for developing e-contents and conducting e-courses. The university's LMS is the largest area of e-learning content, attendance, progress, evaluation and access history because it encompasses all learning activities [4]. As of February 2021, out of 1,286 courses offered by 447 instructors, 90.5% (1,164 courses) at the Mongolian National University of Education (MNUE) have integrated e-contents into their curriculum, resulting in a total of 13,431 e-learning materials were uploaded into LMS [5]. We analyzed teacher-prepared e-learning materials for 59 different subjects.

A survey, taken from students who studied e-courses revealed what forms of e-learning materials were available in LMS, what forms of e-learning materials were more suitable for students, and whether they supported independent learning.

1.1   E-Learning

Education trends, the rapid growth of information technology, and people's desire to study at any time and from any location have made it vital to incorporate e-learning at all levels of education. Citizens living and working in the twenty-first century can freely communicate, engage in social interactions, take courses taught by the world's greatest academics, and learn for the rest of their lives through e-learning and technology-based training [6]. The implementation of e-learning is not an easy task that can be solved simply by transforming traditional learning materials into digital and interactive forms and uploading them to the learning management system, but rather it leads to the problem of developing and designing them as a complex teaching and learning activity [7]. When conducting e-learning, it is necessary to plan lessons carefully, provide methodical sample materials, and work as a team [8].

In this regard, along with the employment of various teaching approaches in the field of education, hybrid learning, blended learning, and flipped learning have emerged as new teaching trends throughout the world, particularly extensively introduced at universities in highly developed countries [9].

1.2   E-learning Materials

E-learning resources may significantly increase students' awareness and enthusiasm for studying, as well as improve their learning techniques and independent knowledge and education. Moreover, they play a crucial role in maintaining and raising the quality of education by contributing to improved teaching standards and enhanced learning outcomes.

The creation of e-content for use in learning and teaching is a step-by-step procedure [10]. E-learning content should be enhanced with media components such as text, images, audio, video, and so on, and it should be presented to learners in a way that supports their learning style and independent learning [11].

E-learning material include more than just textual information; 3D animated images, simulations, learning games, and interactive tools are incorporated into e-learning materials to support students' varied learning styles [12]. In e-learning, communication between stakeholders can take several forms, including interacting with the teacher, with other students, and with course content [13]. The learner's engagement with the information is crucial to e-learning and a vital aspect of any kind of learning, particularly in e-learning [14].

Reading materials, audio, video, multimedia, simulations, assignments, discussion forums, and learning games are examples of learning materials used in e-learning. Listening and reading materials, on the other hand, impact cognitive memory and understanding but do not lead to creative activities such as doing, applying, and utilizing by the learner [15].

Therefore, it is necessary to prepare and use other e-learning materials considering the student's peculiarities. For example, selecting and preparing interactive, video, educational games, virtual labs, and simulations that may be utilized in conjunction with numerous cognitive tasks that are appealing to students, independent learning, and development [16].
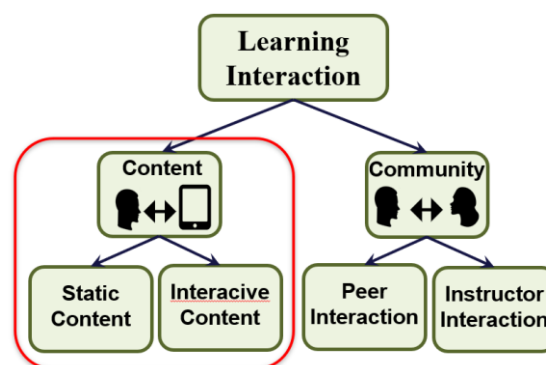

Fig. 1. E-learning interaction

Source: Graham, Charles. (2006). Blended learning systems: Definition, current trends, and future directions.

The use of synchronous and asynchronous tools to enable communication between stakeholders in training can increase the quality and results of e-learning and create a suitable atmosphere for cooperation [17].

In e-learning, learners should be able to use e-materials for self-directed learning. As a result, when interacting with the material, it should be possible to pause, rewind, repeat, and when teachers create e-learning materials, they can do the following for each content:

- Provide material in various formats such as text, audio, and video.
- Make the material readable on screen or printable
- Create exercises that require students to interact with the content and investigate the topic in greater depth.
- Enough materials should be prepared for participants to interact with the content including virtual laboratories, simulations, online searches, scenarios, case studies, and so on, so that participants may engage with the information and learn about the issue independently.

Many elements influence a student's performance, including age, motivation, environment, and teaching approach. Furthermore, some students quickly recognize what they have seen and read, but others prefer listening, exercises, chores, and discussion. This is explained by learning style [18].

The VAK model takes into account three types of learning: visual, auditory, and kinesthetic. Students with a visual learning style can use e-learning materials that include maps, charts, pictures, and other symbols; students with an auditory learning style can learn through audio, video, conversation, lecture, and discussion; and students with a kinesthetic learning style prefer hands-on learning, such as videos, exercises, interactive materials, and educational games [19]. In e-learning, the instructor is responsible for creating a variety of learning resources, leading and inspiring students, and providing them with information that suits their requirements [20].

2   Research Methodology

A study was conducted on a total of 59 online course materials at the LMS of the MNUE, representing various disciplines. These materials covered subjects related to natural science (19 courses), social science (12 courses), primary education (10 courses), and pre-school education (18 courses).

For course analysis, the online course assessment criteria based on the online learning consortium criteria OSCQR 4.0, CDC e-course requirements, and SREB criteria were utilized [21].

A 15-question questionnaire was collected from 376 students of I-IV courses from 7 constituent schools of the MNUE who studied the above 59 courses online to find out which forms of e-learning materials were better suited to the student's learning style and independent study. The study included 12.8% (48) of I year students, 18.9% (71) of II year students, 37.5% (141) of III year students, and 30.9% (116) of IV year students.

The SPSS program was used to examine the research outcomes.

3   Research Findings

3.1 An analysis of e-learning materials

In the analysis of e-learning materials, Table 1 shows the quantitative indicators classified by natural science, social science, preschool education, primary education, and forms of e-learning materials. The most prevalent forms of e-learning materials in LMS are PDF, PPT files, and text documents (Table 1).

Table 1. The forms of course e-materials

Lesson types		Natural Science	Social Science	Pre-School	Elementary	Total	
Text documents	Lecture	3	1	3	3	10	181
	Lab/practice	28	4	15	14	61	
	Seminar	18	22	19	13	72	
	Other	4	16	6	12	38	
PPT, PDF Files	Lecture	83	79	78	65	305	948
	Lab/practice	121	66	45	54	286	
	Seminar	74	95	91	70	330	
	Other	7	3	8	9	27	
Video	Lecture	15	11	31	17	74	155

	Lab/practice	18	7	23	20	68	
	Seminar	2	2	5	4	13	
	Other	-	-	-	-	-	
E-book	Lecture	2	0	3	1	6	42
	Lab/practice	15	9	4	2	30	
	Seminar	2		2	1	5	
	Other	1				1	
Virtual laboratory	Lecture					-	61
	Lab/practice	54				54	
	Seminar	7				7	
	Other					-	

It can also be noted that only a few professors create and use video resources in lectures and laboratory sessions (Figure 1).
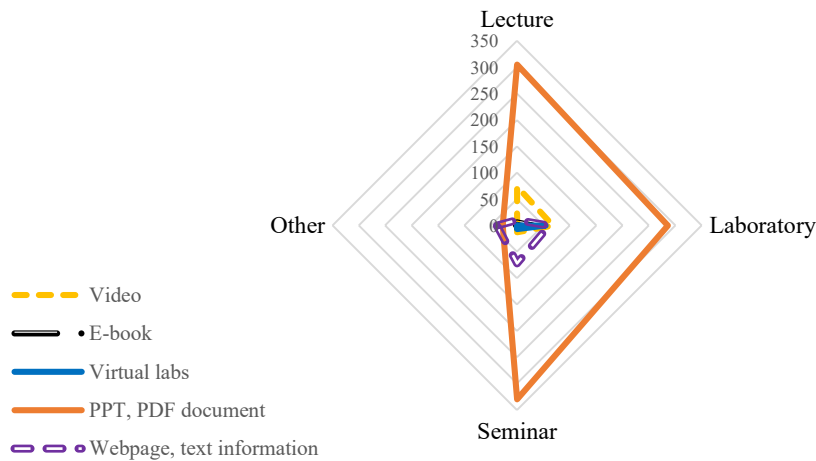
Fig. 1. The relationship between forms of courses and e-materials

3.2 Questionnaire survey of students

The questionnaire consists of general information and research questions. Research questions and findings are provided below.

Question-1: Learning styles of students

Learning styles of students majoring in Social science, Natural science, Preschool education, and primary education were studied (Table 2).

<p align="center">Table 2. The learning styles of students</p>

Learning styles	Students studying Social Science		Students studying Natural Science		Students studying Pre-School teacher		Students studying Elementary education teacher	
Visual	66	45.5%	63	54.8%	25	30.8%	21	60.0%
Auditory	56	38.6%	37	32.2%	37	45.7%	11	31.4%
Kinesthetic	23	15.9%	15	13.0%	19	23.5%	3	8.6%
	145		115		81		35	

According to the table, the visual learning style of students was the most prevalent in social science 45.5%, natural science 54.8%, and primary education 60%. However, the data shows that the auditory learning style was prominent among Preschool education students. Furthermore, the kinesthetic learning type was the most prevalent in primary education.

Question 2: Which forms of e-learning material were popular in LMS?

It can be seen in Figure 2 that the students who studied e-courses answered that text documents or PDF and PPT files occupy the majority of the LMS, while video materials occupy 29%, and e-books and links occupy 18%. However, the percentage of virtual laboratories and interactive materials is relatively small.
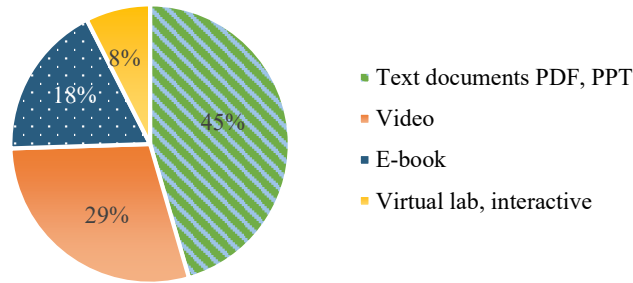

Fig. 2. The percentage of E-learning materials

Question 3: Which of the following forms of e-learning materials was most suited for studying lectures, seminars, and labs? Choose from the e-materials that are most suitable for you.

The graph below shows the responses of the students regarding the appropriate form of e-learning materials for lectures, seminars, laboratories, and practical lessons.
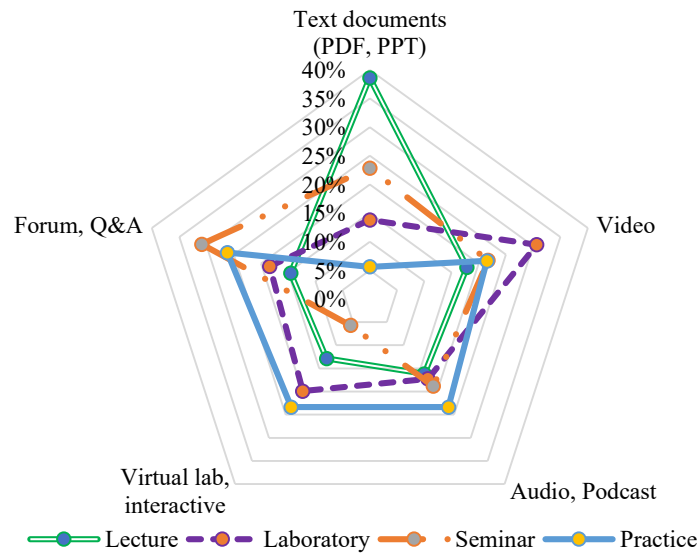
Fig. 3. The forms of courses

The students who participated in the survey said that text documents are most suitable for lectures, but podcasts and audio are also acceptable. In addition, video materials are used in laboratory sessions; Figure 3 shows that discussion is more suitable for seminar sessions. The graph shows that podcasts and audio are more suited for practical lessons.

Table 3. The learning styles of students and their evaluation of e-learning materials
What is your learning style? * Please evaluate the e-learning materials of the LMS
Crosstabulation
Please evaluate the e-learning materials of the LMS?

			Not useful	Slightly useful	Neutral	Useful	Very useful	Total
What is your learning style?	Visual	Count	27	23	40	34	51	175
		% within What is your learning style?	15.4%	13.1%	22.9%	19.4%	29.1%	100.0%
	Kinesthetic	Count	12	12	24	6	6	60

		% within What is your learning style?	20.0%	20.0%	40.0%	10.0%	10.0%	100.0%
	Auditory	Count	25	26	36	23	31	141
		% within What is your learning style?	17.7%	18.4%	25.5%	16.3%	22.0%	100.0%
Total		Count	64	61	100	63	88	376
		% within What is your learning style?	17.0%	16.2%	26.6%	16.8%	23.4%	100.0%

Out of a total of 175 respondents, 46% have a visual learning style, and 16% of the respondents, which amounts to 60 individuals, have a kinesthetic learning style. Meanwhile, 38% of the participants, 141 individuals, have an auditory learning style.

When asked to assess the e-learning materials in the LMS, 48.5% of students with a visual learning style evaluated it as adequate or good enough, while 40% of students with a kinesthetic learning style rated it as "moderate." 38.3% of the students who are auditory learners rated it as satisfactory or good enough. Also, the majority of the students who participated in the survey (151) 40.2% answered that the e-learning materials in the LMS were adequate and sufficient.

The chi-square test results indicate a statistically significant association between learning styles and evaluations of the e-learning materials (x^2 = 17.213, df = 8, P = 0.028). It is worth noting that none of the expected cell counts in the contingency table are below 5, with a minimum expected count of 9.73, which ensures the reliability of the chi-square test results. The findings suggest that different learning styles may influence the perceived usefulness of the materials, with variations observed among visual, kinesthetic, and auditory learners.

Question 4: Choose the best e-material for self-study from the list below.

Textual information, video resources, and e-books were discovered to be more acceptable for students to learn independently.
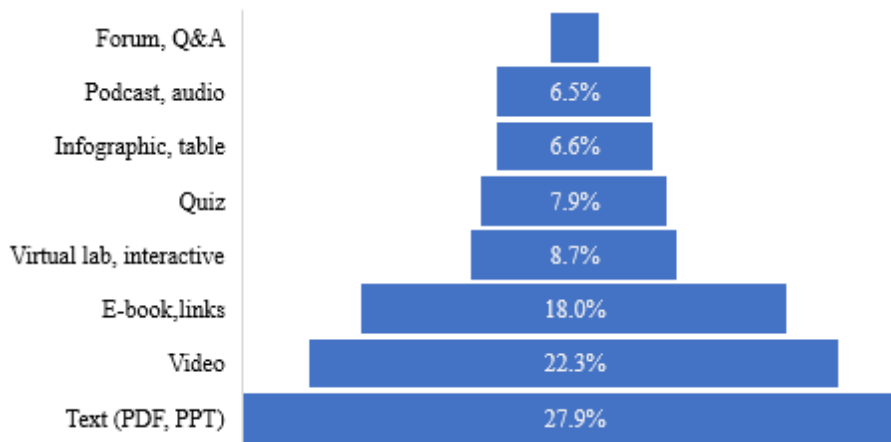

Fig. 4. The e-learning materials are suitable for students to learn independently

Based on this, the development of e-learning materials with multiple versions, such as videos, e-books, and interactive, rather than just text documents, demonstrates that there is a need to prepare them according to the peculiarities of students with different learning styles.

Figure 4 shows that for one topic, it is required to create and use a variety of learning resources that support the student's activities such as seeing, listening, executing, writing, experimenting, and creating.

The graph below illustrates that there is a clear association between the learning style of the learner and the forms of the e-learning material (Figure 5).
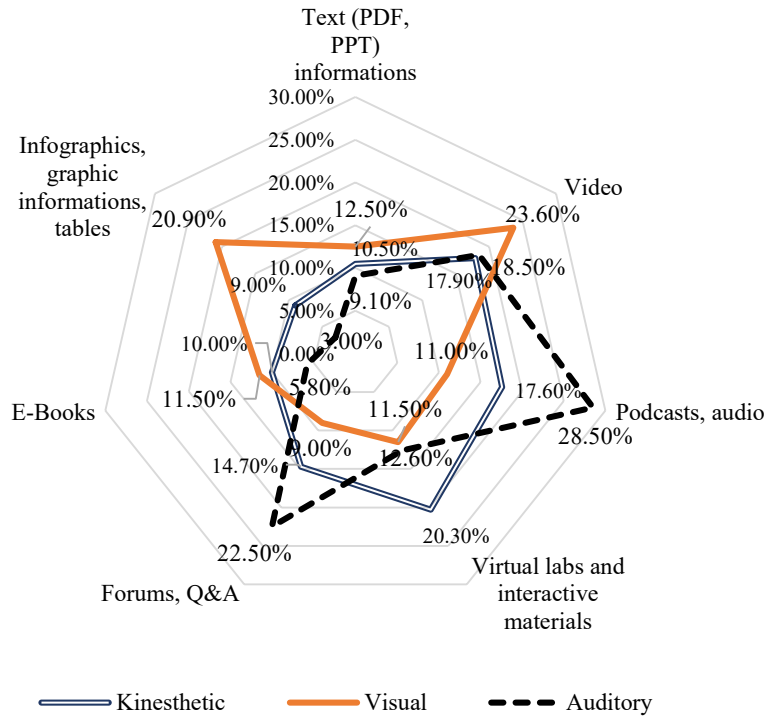
Fig. 5. The relationship between the learning styles of students and the forms of e-learning materials

Consequently, for each content, it is necessary to develop different e-learning materials suitable for the student's learning style. Based on the results of the research, we have discussed the relationship between types of lessons, e-learning materials, and student learning styles in the following figure.
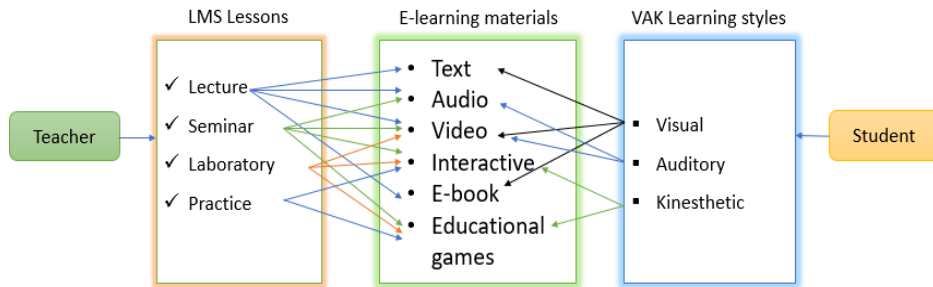

Fig. 6. The relationship between e-learning materials and student's learning styles

Since the student often interacts with e-learning materials developed by the teacher rather than directly communicating with the teacher, if the e-learning materials are interactive according to the learning style, it reduces the student's cognitive load and increases creativity.

4   Discussion

The goal of this study is to determine if the forms of e-learning materials used in the ULMS are compatible with the student's learning styles. A factual research study on e-learning materials, along with a questionnaire survey of students, was undertaken.

According to the research findings, textual information (pdf, ppt) accounts for 80% of e-learning materials, video information accounts for 11%, e-books account for 4%, and virtual laboratories account for 3% (Table 1). This indicates that our findings do not match with the findings of El-Sabagh [12]. For instance, e-learning materials do not fully match the student's learning styles such as visual, auditory, and kinesthetic and the lack of interactive elements makes it difficult for the student to interact with the content.

In terms of forms of e-learning materials, lectures include textual information, as well as audio and podcasts; and discussion in seminar classes; our research shows that video materials are more suitable for laboratory classes and podcasts and audio are more suitable for practical classes. E-learning materials may be developed and used in

several ways, which can be beneficial to students with different learning styles [12]. Research shows that students prefer textual information, videos, e-books, and interactive and virtual materials for self-directed learning. However, the e-learning materials considered in the study do not have various versions.

5   Conclusion

Except for the synchronous interaction of e-learning, the student studies independently according to the materials and instructions placed in the ULMS. According to the electronic materials prepared by the teacher and the questionnaires received from the students, most of the information is in written form and video.

According to the study, the number of visual and auditory students is almost the same. As a result, appropriate learning resources for students with different learning styles must be developed so that they can study independently.

E-learning materials with text, audio, video, and interactive features are appropriate for lectures, and seeing, and listening activities are prevalent, while materials such as text, audio, video, interactive, educational games, and e-textbooks are used and viewed for seminars, laboratories, and practical lessons and most suitable for auditory and kinesthetic learners.

According to research, e-learning materials are frequently static, textual content does not develop interaction with the student and does not accommodate different learning styles.

In the future, emphasis should be placed on incorporating interactive aspects into textual and video resources, as well as producing interactive e-learning materials such as animations, simulations, and educational games.

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