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Investigation of pre-service TESOL teachers' perceptions towards multimedia–based textbook development and usage

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Abstract

The purpose of the study is to present the results of investigating pre-service teachers' perceptions of their readiness to develop and use multimedia-based English language training textbooks. The dimensional structure of the designed readiness is regarded as a complex personal integrative quality. A corresponding survey questionnaire is compiled to determine its content. The study included 81 senior students from the foreign language faculty at Karaganda Buketov University. The research's methodology included statistical analysis of quantitative data, experimental training and participant self-assessment questionnaires. Preliminary tests were conducted in both the experimental and control groups aimed at identifying participants' perceptions of their initial level of readiness for the development and use of multimedia-based textbooks. Participants in the experimental group participated in an experimental course on technology development and the use of multimedia-based textbooks with the presentation of their final project. When the teaching period was over, the post-test was taken. The results demonstrated the efficiency of the complex assessment of readiness in the mentioned area enabling the definition and correction of gaps in its structural content. The designed course proved its effectiveness in practice as asserted by the post-test scores.

Keywords: Development of multimedia-based textbooks, Digitalization of education, Dimensional structure of readiness, English language training, Information communication technologies, Multimedia technologies, Multimedia, Multimedia-based textbook, Pre-service TESOL teachers, Teachers' readiness.

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Contents

Contribution of this paper to the literature

The study illustrates the results of assessing pre-service TESOL (Teaching English to Speakers of Other Languages) teachers' readiness for the development and use of multimedia-based textbooks that present certain interests for academics and education practitioners. The suggested procedure of assessment was carried out regarding the readiness dimensions: motivational, cognitive and operational.

1. Introduction

The Republic of Kazakhstan's active and prevalent use of modern digital and multimedia technologies in social and economic processes along with the fast digitalization of every aspect of society have resulted in a comprehensive transformation of the country's educational system. One of the earlier topics for updating the educational system in the aspect of changing the format, instrumental base, technologies and quality of the content of the overall educational environment was determined by the impact of technological advances and the expansion of digital space capabilities.

Gribanov (2019) in his review stated that "digital transformation inevitably entails reformation of the education system". Moreover, a new educational format based on the usage of digital and distance technologies and e-learning tools became mandatory in Kazakhstan in March 2020 in terms of preventing the spread of the COVID-19 infection.

The application of multimedia and modern information and communication technologies determines the implementation of the e-learning concept. The extension of a teacher's responsibilities from "teacher-translator of knowledge" to "teacher-developer of digital educational content" has been influenced by the need to create new types of educational content such as online accessible digital multimedia textbooks, tutorials, presentations, etc. Thus, the urgent need of e-learning implementation and digital transformation of education conditioned the change of the professional requirements for modern teachers' competences that is evidenced by the analysis of educational needs in the aspect of digitalization of education and reflected in Kazakhstan's regulatory documents, namely, *Strategic Plan of the Republic of Kazakhstan Development until 2025 year* (Institute of Legislation and Legal Information, 2012) and *Kazakhstan-2050* (Institute of Legislation and Legal Information, 2018) that ensured the development of innovative technologies and modernization of education, state programs of *Digital Kazakhstan* (Institute of Legislation and Legal Information, 2017) and *State Program of Developing Kazakhstan's Education and Science for 2020-2025* (Institute of Legislation and Legal Information, 2019), the President Tokayev's Address *People Unity and System Reforms as the country's prosperity steady foundation* (Akorda, 2021).

The analysis of the present research conducted in the field of the usage of multimedia-based textbooks in the field of teaching English concludes that certain contradictions have appeared between:

1) the increasing scope of information communication technologies and multimedia technology usage in the professional activities of in-service EFL (English as a Foreign Language) teachers and the existing practice of teaching information communication technologies to pre-service TESOL teachers providing only the development of their basic skills as users but not efficient developers of electronic multimedia educational products including multimedia-based textbooks.

2) Manifestation of a steady tendency for teachers to develop their own multimedia– based textbooks (by using a variety of software, expanding the list of skills for working with information, mastering various information processing technologies, developing digital content and their own electronic multimedia materials) and a lack of pre-service teachers structured and methodically based training systems in the field of designing and implementing the above products.

3) Teachers' present motivation to develop multimedia-based textbooks and their insufficient knowledge and negative perception of their readiness in the given field.

The aforementioned tendencies define the current research problem which is to determine target problems in this area and vectors for their solution based on the findings after evaluating the pre-service TESOL teachers' perceptions of their readiness to create and implement their own multimedia-based textbooks.

2. Literature Review

Multimedia-based textbooks are defined in the context of the current study as digital educational programme products that offer combinations of various kinds of media in any order, including text, audio files, video materials, graphics, figures, pictures and animations designed to address specific didactic tasks assigned during the teaching process. Multimedia programs transmit the content in several ways:

1. The content is rendered through the hyperlinks which connect the different types of information blocks presented as video and audio files as well as texts or graphical objects. The page can contain numerous hyperlinks each with its own link and route to the designated piece of information.

2. The information is provided and operated interactively allowing the user to select the time, mode, order and time of contact.

- The following characteristics define the benefits of using multimedia-based textbooks in the teaching process to some extent: The presence of a program's feedback enables a learner's motivation, self-assessment and self-correction (Brett, 1998; Caftori, 1994; Van Dusen & Worthen, 1995).
- Interactivity which suggests that a learner can build up his own learning trajectory, navigate and surf within the textbook and move to external internet resources through the hypermedia links using moving graphics and objects can be more engaging in the learning process compared with the facilities of printed textbooks (Barab, Young, & Wang, 1999; Khusainova, 2007; McCarthy, 2011; Reynolds, 2011; Sidorova & Afanasyeva, 2017; Warlick, 2004; Waters, 2011; Williams & Brown, 1990).
- Possibility of individual learning and guidance (Baking, Ibarra, & Mukminin, 2023; Barab et al., 1999; Brett, 1998; Heider, Laverick, & Bennett, 2009; Kim, 2012; Mardis, Everhart, Smith, Newsum, & Baker, 2010).

- Self-paced mode of learning activity (Liao, 1992; Najjar, 1996; Roy, Beauchamp, & Boyer, 2018; Venkatesh, 2000; Yakushina, 2002).

Users can perceive information in a complex and integrative way and fully understand it due to a wide range of visuals and an engagement with figurative thinking modes. Teachers can use the multimedia programs to combine the explanation of theory with the practical demonstration of the processes and objects studied.

Numerous studies have been devoted to the specifics of the application of multimedia-based textbooks in the educational process as well as their effect on learners' academic performance. Multimedia educational software can be more beneficial in comparison with traditional textbooks due to the provision of moving objects and changing information realized with the help of computer graphics. Multimedia technologies provide simultaneous, not sequential perception of the information presented as several sense organs are engaged in a parallel mode throughout the process leading to the possibility of greater assimilation of the educational content.

Nicholls, Merkel, and Cordts (1996) and Lai (1998) analyzed their efficiency in the educational framework in their investigation due to the comparison of static and dynamic graphic objects. Lai's results showed the effectiveness of static graphics in improving educational outcomes while Nicholls et al. (1996) in their research stated the benefit of animated objects in intensifying the learning process (Lai, 1998; Nicholls et al., 1996).

Multimedia-based textbooks can be applied to solve a wide range of educational needs both in groups and independently varying in complexity and volume of training tasks. Najjar (2001) advised educators to use multimedia in a supportive role rather than a decorative one as it does not meet instructional objectives.

Mikk (2000) investigated the effectiveness of multimedia-based textbooks in an experimental frame based on the analysis of the learners' academic performance after their implementation into the learning process and the potential influence of side factors on the results achieved after the usage of corresponding multimedia-based textbooks. Barat (2015) in his research revealed the effect of multimedia teaching programs on learners' educational achievements. He proved that multimedia-based textbooks can be of great advantage and have a significantly positive effect on students' learning outcomes in the case of methodically appropriate and correct usage in the educational context (Barat, 2015).

Moreover, a wide range of studies were presented about the design principles (Alessi & Trollip, 2001; Berry, 2000; De Koning, Tabbers, Rikers, & Paas, 2009; Humphreys, 2001; LaSpina, 1998; Mikk & Luik, 2003) and criteria for evaluating the efficiency of multimedia-based textbooks and programs (Bayraktar, 2001; Caftori, 1994; Galaguzova & Musilimov, 2012; Goyne, McDonough, & Padgett, 2000; Schnotz et al., 2011; Uden & Campion, 2000; Wang & Sleeman, 1993) in the educational process.

An analysis of research in this area revealed that most of the work in this area was aimed at studying the problem of developing modern digital multimedia resources and their effectiveness in the educational context where attention was focused mostly on the technical component but the methodological aspect (training pre-service teachers to develop and implement these resources into their professional activity) was often missed.

An investigation of the approaches to the issue of multimedia-based textbooks used within the education context revealed a lack of studies on the problem of the readiness of pre-service teachers to develop and apply multimedia textbooks. It is obvious that in modern stage of education digitalization pre-service teachers are faced with the urgent necessity of incorporating multimedia technologies into their everyday professional activities and experiences. It is crucial that they understand how to apply them correctly during the training process and the risks and consequences of using them incorrectly (Smagulova, Sarzhanova, Tleuzhanova, & Stanciu, 2021). The ability to create multimedia-based educational resources (digital multimedia textbooks, tutorials, interactive presentations, etc.) and to master these technologies has become crucial for modern teachers as it affects the efficacy of their work.

However, studies on educators' preparedness to use new technology choices and digital multimedia tools in their work found that 66% of teachers were unprepared to use modern multimedia and ICT in a classroom (Kajder, 2005). Subsequent analysis of the question revealed that teachers predominantly listed issues such as lack of access to modern ICT and tools, resources and knowledge in the relevant field and an inadequate level of practical skills for applying these technologies in the educational context as barriers keeping them from using modern multimedia tools and ICT in an effective way (Barone & Wright, 2008). Teachers may have low self-esteem about their proficiency with and preparedness for using modern technology in their work (Davis & McClain, 2003).

Most studies focus on the technical performance and design choices of multimedia-based textbooks rather than the intricate process of creating multimedia educational products with regard to pedagogy, teaching methods, physiology and ergonomics which adds to the problem's complexity. Therefore, pre-service teachers may often develop the content and form of multimedia-based textbooks in a spontaneous and instinctive way. They are not aware of the foundations of the proper development of multimedia educational products which can be further beneficially applied by the learners leading to better results in foreign language acquisition without being exposed to potential physiological harm, pedagogical miscalculation or uneven and unsuccessful assimilation of the educational material.

The above mentioned brings us to the question to be investigated within the framework of the present study which lies in defining and assessing pre-service TESOL teachers' readiness level regarding multimedia-based textbook development, usage and finding ways to overcome existing problems in this field. The methodical and didactic tasks set in the teaching process are carried out through the creation of multimedia educational products. The specifics of the approach to evaluating pre-service TESOL teachers' preparedness towards the development and use of multimedia-based textbooks are concluded by identifying the structural dimensions of readiness as an integrative personal quality. The structure of the future teacher's readiness to develop and use multimedia-based textbooks was analyzed from the positions of personality-activity theory and understood as an integrative quality, reflected in a set of interrelated components. Moreover, it is considered as an ability to solve the tasks in the corresponding field of developing multimedia educational products. Thus, we distinguish a teacher's readiness to develop and use multimedia-based textbooks in three interconnected dimensions: motivational, cognitive and operational.

3. Materials and Methods

The study included 81 senior students from the foreign language faculty at Karaganda Buketov University majoring TESOL (40 participants made up the control group and 41 composed the experimental group).

When defining the criteria for assessing pre-service teachers' perceptions of their readiness towards multimedia-based textbooks development and usage, we have identified three main dimensions in the designated area to be covered:

- Motivational (this includes motives, beliefs and attitudes towards multimedia-based educational resources development and usage as well as the presence of sustained interest in their development).
- Cognitive (this implies knowledge of basic concepts concerning multimedia educational resources and the methods of development and usage).
- Operational (this reveals the basic skills and abilities to develop and implement multimedia educational resources).

The instruments used for the present research were the author's questionnaire adapted from Surova (2008) "self-assessment of pre-service TESOL teachers' perceptions towards the development and use of multimedia - based textbooks". The questions included in the questionnaire were distributed according to the three dimensions described above. The self-assessment method was used to identify pre-service teachers' opinions about their perception of readiness, since self-assessment acting as one of the constituent elements of self-awareness, affected all aspects of personality manifestation. TESOL teachers' opinions about the creation and application of multimedia-based textbooks were evaluated using the following criteria:

1) The presence of stable motives for multimedia-based textbooks development and usage.

2) Scientific and theoretical knowledge about multimedia-based textbooks and methods of their creation for application in teaching.

3) The degree of mastery of practical skills in working with the tools of developing multimedia-based textbooks.

Respondents had to assess their motivational and value orientations towards creating multimedia-based instructional resources in addition to their level of knowledge, skills and abilities when completing the questionnaire. The questionnaire comprised 18 questions (statements to assess) organized in three sections with 6 statements, each corresponding to identified dimensions: motivational, cognitive and operational.

The answers were evaluated on a 10-point scale. When processing the data, scores were calculated for each dimension as well as the total number of points indicating the current state of their perception of their readiness to develop and use multimedia-based textbooks. The following levels, identifying pre-service teachers' current state of readiness to develop multimedia educational resources were distinguished: insufficient, low, sufficient and high.

The degree of independence and awareness of actions in the process of development and application of multimedia-based textbooks were chosen as the basis for highlighting the levels of readiness.

The characteristics of the selected levels are as follows:

I. Insufficient level: Pre-service teachers have extremely poor knowledge and skills of multimedia-based textbook development technology and methodology of their application in the educational context. The level is characterized by a lack of independence in multimedia-based textbooks development and usage and absence of awareness and consistent motivation for their creation.

II. Low level: Pre-service teachers have minimal basic theoretical and practical knowledge in the field of multimedia-based textbooks development technology and methodology for their application in the educational context. The level is characterized by the ability to transfer already learned algorithms just to reproduce a copy of the sample using the demonstration example. The pre-service teachers have an insignificant focus on developing and using multimedia educational products.

III. Sufficient level involves the mastery of pre-service teachers with strong knowledge in the field of multimedia-based textbook development technology using software tools and methodology of their application in the educational context, mastery of practical skills and ability in their creation. Pre-service teachers independently, consequently and consciously put the knowledge gained into practice in the creation of multimedia-based textbooks.

IV. High level corresponds to the highest level of pre-service teachers' readiness to develop multimedia-based textbook both with the help of software tools and using programming languages as well as to use them in a methodically appropriate way in their professional activity. Pre-service teachers independently develop multimedia-based textbooks in accordance with all requirements that should be met during their creation.

Based on the sum of points scored, pre-service TESOL teachers' perceptions towards the multimedia-based textbooks development and usage at the insufficient level are defined as strongly negative, at the low level as negative, at the sufficient level as positive and at the high level as strongly positive.

The indicators identified as the basis for determining the current state of their perception of readiness to develop multimedia educational resources are represented in Table 1.

Table 1. Correspondence of points with the current state of participants' (pre-service TESOL teachers) perceptions of multimedia-based textbook development and usage.

Identifiers	**Levels of readiness in multimedia – based textbook development and usage**			
Levels	**Insufficient**	**Low**	**Sufficient**	**High**
Points	from 18 to 60	from 61 to 100	from 101 to 140	from 141 to 180

Table 2. Correspondence of score obtained for each of the levels of pre-service TESOL teachers' readiness dimensions (Motivational, cognitive and operational).

Identifiers	**Levels of the dimensions (Motivational, cognitive and operational) of pre-service TESOL teachers' readiness to multimedia – based textbooks development and usage**			
Levels	**Insufficient**	**Low**	**Sufficient**	**High**
Scores	from 6 to 19	from 20 to 33	from 34 to 47	from 48 to 60

Table 2 presents the quantitative indicators (scores gained in three sections of the questionnaire, each corresponding to identified dimensions) for the four levels of pre-service TESOL teachers' readiness dimensions: motivational, cognitive and operational.

4. Results and Discussion

The results of the questionnaire conducted in the control and experimental groups showed an insignificant difference in the indicators of participants' readiness towards the development and use of multimedia-based textbooks. The distribution of readiness dimensions according to the levels identified is shown in percentage ratios in the control group as shown in Table 3.

Table 3. The structural dimensions of participants' (pre-service TESOL teachers) readiness towards multimedia-based textbook development and usage were distributed according to the levels (preliminary test control group results).

Level	Motivational	Cognitive	Operational	General
Insufficient	5%	90%	100%	82%
Low	80%	10%	0%	18%
Sufficient	15%	0%	0%	0%
High	0%	0%	0%	0%

According to the data obtained on defining participants' general level of readiness towards multimedia-based textbook development and usage, an insufficient level prevailed in the control group at 82% (30 out of 39 students). 18% of respondents' (9 out of 39 students) perceptions corresponded to the low level of readiness for the development and use of multimedia-based textbooks. No participants with general sufficient and high levels of readiness were identified.

The results showed that in the context of the distribution of readiness dimensions the motivational dimension of the majority of respondents was at the low level (80%) while the cognitive and operational ones was identified at the insufficient level (90% and 100% respectively). At the same time, regarding the presence of the motivational component only 15% of respondents (6 persons) was identified as having a sufficient level which indicated that those students were motivated to develop and use multimedia-based textbooks despite the insufficient level of formation of the cognitive and operational dimensions of readiness enabling the ability to effectively create and implement these educational products. Table 4 presents the pre-test distribution of readiness dimensions in the percentage ratio in the experimental group.

Table 4. The structural dimensions of participants' (pre-service TESOL teachers) readiness towards multimedia-based textbook development and usage were distributed according to the levels (preliminary test experimental group results).

Level	Motivational	Cognitive	Operational	General
Insufficient	2.5%	87.5%	100%	82.5%
Low	80%	12.5%	0%	17.5%
Sufficient	17.5%	0%	0%	0%
High	0%	0%	0%	0%

In the experimental group, the predominant level of future TESOL teachers' readiness towards multimedia-based textbook development and usage was also found to be insufficient (82.5% of 33 respondents out of 40). The general level of readiness of 17.5% of participants (7 out of 40 respondents) corresponds to a low level. The data obtained showed that only 17.5% of respondents had a motivational dimension corresponding to a sufficient level of their readiness while the rest of the dimensions (those of cognitive and operational ones) were still poorly developed.

Table 5 shows the comparative data of the results obtained in both samples.

Table 5. Comparative analysis of the initial level of participants' (pre-service TESOL teachers) readiness towards multimedia-based textbook development and usage according to pre – test results in the control and experimental groups.

Samples	Control group				Experimental group			
	Number of students (Percentage, %)							
Readiness dimensions levels	Motivational	Cognitive	Operational	General	Motivational	Cognitive	Operational	General
Insufficient	2 (5%)	35 (90%)	39 (100%)	30 (82%)	1 (2.5%)	35 (87.5%)	40 (100%)	33 (82.5%)
Low	31 (80%)	4 (10%)	0 (0%)	7 (18%)	32 (80%)	5 (12.5%)	0 (0%)	7 (17.5%)
Sufficient	6 (15%)	0 (0%)	0 (0%)	-	7 (17.5%)	0 (0%)	0 (0%)	-
High	0 (0%)	0 (0%)	0 (0%)	-	0 (0%)	0 (0%)	0 (0%)	-

Comparing the results in both samples we can see the absence of any crucial distinctions between the participants' general level of readiness to develop multimedia-based textbooks. The survey revealed extremely low indicators of participants' (pre-service TESOL teachers), theoretical basis (cognitive dimension) and practical mastery in creating multimedia-based textbooks (operational dimension).

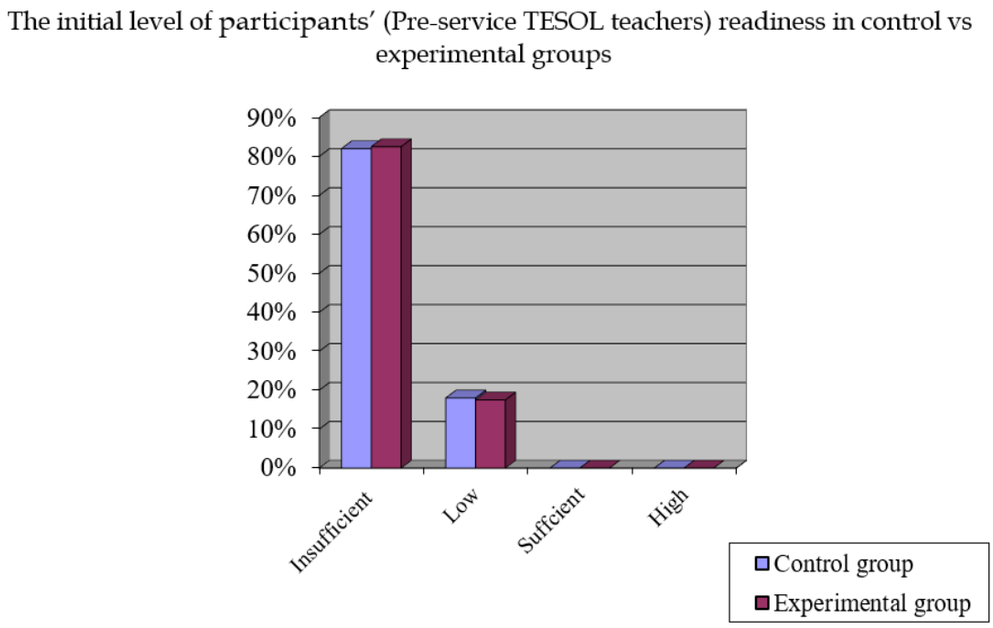

Figure 1. Comparative analysis of the initial level of participants' (pre-service TESOL teachers) readiness for multimedia-based book development and usage according to pre-test results in the control and experimental groups.

Figure 1 illustrates that pre-service TESOL teachers' readiness to develop and use multimedia-based books according to pre-test results in the control and experimental groups was found to be at a similar level with some slight differences. The insufficient (82% in the control group) and low (82, 5% in the experimental group) levels of readiness predominate whereas the sufficient and high ones are not revealed. The illustrated condition of an examined quality has ensured the necessity of conducting a training course aimed at the development of the corresponding knowledge and skills increasing the participants' readiness towards designing and using multimedia-based textbooks.

The hypothesis on the fairness of the laws of distribution of points scored in both samples was checked with the help of the t-student criterion calculated in the Microsoft Excel program. The hypothesis of fairness of the laws of distribution of the number of points scored in both considered general populations is checked in this way.

H0: Xr = Yr , i.e. the hypothesis H0 assumed that the two general populations X and Y compared by the selected features did not differ from each other or that the differences were not statistically significant and were random. In the case of its rejection, hypothesis H1 was accepted.

H1: Xr ≠Yr, according to which the differences revealed have the systemic character and cannot be regarded as random ones.
The t-student criterion is calculated by the following formula (see Equation 1).

$$t_{St}=\frac{(\overline{x_e}-\overline{y_e})}{\sqrt{\frac{s_x^2}{n_x}+\frac{s_y^2}{n_y}}}, \quad (1)$$

$$\text{here } s_x^2=\frac{1}{n_x-1}\sum_{i=1}^{n} \quad , \; s_y^2=\frac{1}{n_y-1}\sum_{i=1}^{n} \quad (2)$$

In Equation 2, we have

- Sample average means.

s_x^2, s_y^2 - Unbiased estimators of the population variance for both samples.

n_x, n_y – Number of variants in samples (sample size).

In our case, t_{St} was equal to

$$t_{St}=\frac{(50{,}15385-51{,}85)}{\sqrt{\frac{8{,}086826}{39}+\frac{9{,}913915}{40}}}= \quad t_{St}=\frac{(50{,}15385-51{,}85)}{\sqrt{1{,}294929+1{,}092251}}=1{,}00123 \quad (3)$$

Equation 3 presents the results of calculating the empirical value of the criterion (t_{St}) according to the formula (see *Equation 1*) which is equal to 1,00123.

The decision on the reliability of the differences observed between the average means is made based on a comparison of the empirical value of the criterion (t) and the critical value of the criterion (tcr) at a certain level of significance (β). The hypothesis H0 is accepted if t ≤ tcr, and rejected if t > tcr.

Here *t*, the empirical value of the criterion and *tcr* , the critical value of the criterion were compared at the level of significance *β*. If *t* ≤ *tcr* we accept the first hypothesis (H0) and if *t* > *tcr*, it is rejected and the second hypothesis (H1) is taken.

The theoretical criterion according to the level β = 0.05 with a degree of freedom of f = 77 was equal to 2.00.

Thus, t=(1.00123) ≤ tcr (2.00), therefore, the null hypothesis was accepted which asserted that the states of the property under consideration were equal for participants of both samples (the control and experimental groups).

The results of the assessments and analysis of the questionnaires indicate that the participants had a poor level of knowledge about the methods used in the development and implementation of multimedia-based textbooks and were not familiar with the theory behind it. Similarly, we concluded that there was a need to organize the course preparing pre-service TESOL teachers for developing and using multimedia-based textbooks.

We developed a training system with target, content, and procedural components to prepare pre-service teachers for the development and usage of multimedia-based textbooks based on the survey analysis that was provided. The methodical system was put into practice by implementing a three-stage training programme that was theoretical, practical and professionally oriented. The program's objectives were to form students' awareness and motivation for creating multimedia-based textbook as well as their theoretical knowledge and skills in designing multimedia textbook and using the related software development tools. This structure and content of a training course were intended to ensure the formation of participants' (future TESOL teachers) readiness for multimedia-based textbook development and usage in term of their structural dimensions.

- Following the identification of difficulties, a course was conducted in the experimental group to teach the fundamentals of creating and using multimedia-based textbooks in the teaching process. The course was structured into three stages: theoretical, practical and professionally oriented. The sequence of passing through the stages provided an integrated approach to the formation of participants' (future TESOL teachers) readiness for multimedia-based textbooks development and usage. The following training tasks are defined in accordance with the participants' (future TESOL teachers') goals about their preparedness for the development and use of multimedia-based textbooks and the problem areas identified during the pre-test survey: Formation of a value attitude, interest and motivation for the development of participants' (future TESOL teachers) readiness for multimedia-based textbook development and usage for solving didactic tasks in their future professional activities.
- Acquisition of a theoretical basis for understanding the technology of multimedia-based textbooks development and usage.
- Acquisition of practical mastery of multimedia-based textbooks for development and usage.

The final task required of pre-service teachers was to create their own multimedia English language textbooks as a control assignment. It was advised that the group members use an object-oriented approach when developing the aforementioned textbooks as they lacked specialized training and familiarity with programming languages. The object-oriented approach implies usage of special programs that have a ready template for organizing the digital educational content into a single multimedia textbook without mastering the programming language. Such programs tend to have intuitively comprehensible interface, easy templates to apply and ready-made solutions for constructing exercises and tests. Pre-service teachers of the control group developed authors' multimedia-based textbooks on their own using the general recommendations given previously and based on the previous knowledge obtained from the course of the curriculum on "Information Communication Technologies in Education."

The projects performed demonstrated non-compliance with the requirements for multimedia-based textbooks which primarily affected the quality of multimedia educational product. The experimental group of pre-service teachers has passed all three stages of training on developing multimedia-based textbooks demonstrated a higher level of quality in the developed projects multimedia textbooks.

During the development of multimedia-based English language textbooks, pre-service teachers independently selected the software tools to develop a multimedia educational textbook and created a multimedia educational tutorial considering the principles of its design and requirements to comply with:

1) Pedagogical requirements (pedagogical expediency).
2) Methodical requirements.
3) Technical requirements.
4) Requirements for interactivity implementation.
5) Requirements for the structure of a multimedia educational tutorial (inclusion in the structure the blocks on navigation, new knowledge or topic presented as audio files, video episodes, text material or their combination exercises on the topic and control test).

The final stage of the study consisted of distributing the questionnaire to both samples repeatedly in order to assess the participants' level of preparation. Its results showed a significant growth in the indicators of all dimensions of participants' (pre-service TESOL teachers) readiness for multimedia-based textbook development and usage in the experimental sample.

Table 6. The structural dimensions of participants' (pre-service TESOL teachers) readiness for multimedia – based textbook development and usage were distributed according to the levels (the control group post-test results).

Level	Motivational	Cognitive	Operational	General
Insufficient	0	-	34	85%
Low	28	72%	6	15%
Sufficient	11	28%	0	-
High	0	-	0	-

Table 6 shows that according to the results of the repeated survey, in the control group, the predominant level of readiness is insufficient (21 respondents out of 39 which is 54% of the total number of participants) and 46% of respondents have the insufficient level (18 people out of 39).

In the control group, there has been a slight shift from the insufficient to the low level of readiness when compared to the pre-test results. However, there has been no discernible progression towards sufficient and higher levels of readiness which would suggest the development of professional and sufficient levels of readiness.

Table 7. The structural dimensions of participants' (pre-service TESOL teachers) readiness for multimedia – based textbook development and usage were distributed according to the levels (the experimental group post-test results).

Level	Motivational	Cognitive	Operational	General
Insufficient	0	-	0	-
Low	2	5%	4	10%
Sufficient	32	80%	26	65%
High	6	15%	10	25%

Table 7 shows that the experimental sample's post-test results reflected positive dynamics in the formation of the participants' readiness for multimedia-based textbook development and usage. 80% of participants have reached a sufficient level and 15% are professional. No participants have been found with the reproductive level of readiness and only 5% of them have remained at the adaptive level of readiness.

Table 8 shows the comparative data of the results in both samples.

Table 8. Comparative analysis of participants' (pre-service TESOL teachers) level of readiness for multimedia-based textbook development and usage was distributed according to the levels in control and experimental samples based on the post-test results.

Group	**Control group**				**Experimental group**			
	Number of students (Percentage, %)							
Perception and readiness components	**Motivational**	**Cognitive**	**Operational**	**General**	**Motivational**	**Cognitive**	**Operational**	**General**
Insufficient	0 (0%)	34 (85%)	39 (100%)	18 (46%)	0 (0%)	0 (0%)	0 (0%)	-
Low	28 (72%)	6 (15%)	0 (0%)	21 (54%)	2 (5%)	4 (10%)	3 (7,5%)	4 (10%)
Sufficient	11 (28%)	0 (0%)	0 (0%)	-	32 (80%)	26 65%)	35 (87,5%)	36 (80%)
High	0 (0%)	0 (0%)	0 (0%)	-	6 (15%)	10 (25%)	2 (5%)	10% (4)

Figure 2 presents the data of the comparative analysis below.

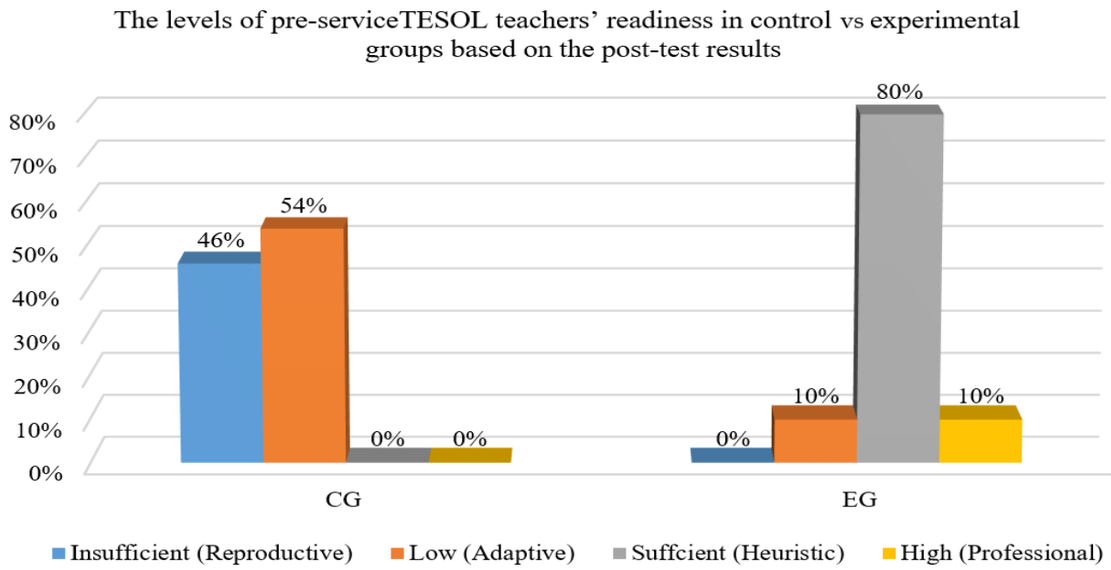

Figure 2. The levels of participants' (pre-service TESOL teachers) level of readiness for multimedia – based textbook development and usage were distributed according to the levels in control and experimental samples based on the post-test results

Thus, the post-score results revealed important positive shifts in the pre-service TESOL teachers' level of readiness for multimedia-based textbook development and usage in the experimental sample.

The reliability of the significance of changes in the dynamics of the quality analyzed was confirmed by the student's t – criterion. We proposed the hypothesis H0: Xr = Yr in order to test the equality of the laws governing the distribution of points scored in the selected samples. Based on this hypothesis, we were able to confirm that there are no statistically significant differences between the control and experimental samples' studied quality at any level. On the other hand, we rejected the hypothesis H1: Xr ≠Yr, which asserts that there are statistically significant differences between the studied quality of the aforementioned samples.

Here *t* is the empirical value of the criterion and *tcr* is the critical value of the criterion was compared at the level of significance *β*. The H0 hypothesis was normally accepted in cases where t ≤ tcr and rejected if t > tcr.

The decision on the reliability of the differences observed between the sample averages was made based on a comparison of the empirical value of *t*-statistic (t) and the critical value of *t*-statistic (tcr) at a certain level of significance (β).

The theoretical criterion was found at the significance level of β = 0.05.

The freedom degree quantity *f* was defined as: if sx2 ≈ sy2, we had

f = nx+ ny – 2, in our case f = 39+40-2 = 77

The *t* value was calculated by the following formula in Equation 4.

$$t_{St}=\frac{(73,66923-125,4)}{\sqrt{\frac{9,024707}{39}+\frac{12,82186}{40}}}=\ t_{St}=\frac{(50,15385-51,8573,66923-125,4)}{\sqrt{1,44511+2,027313}}=24,7548 \qquad (4)$$

Equation 4 presents the results of calculating the empirical value of the theoretical criterion (t_{St}) which is equal to 24,7548.

The critical value of the criterion was found according to a table of values from students' *t*-distribution for the significance level $\beta = 0.05$ with a degree of freedom of f = 77: 1.991.

Thus, t (24,7548) ≤ tcr (1,991), therefore, the null hypothesis H0: Xr =Yr was rejected at the level a = 0.05, and the alternative hypothesis H1: Xr ≠Yr was accepted which statistically proved the confirmed significant distinction in the quality studied in both samples.

The statistical analysis provided us with justification to claim that the changes in the control group were not significant. We had observed significant positive shifts in the experimental sample.

5. Conclusion

The presented survey made it possible to determine the levels of readiness of pre-service TESOL teachers towards multimedia-based textbooks development and usage and determine their perceptions of this readiness based on the method of self – assessment through the questionnaire. The analysis of the data obtained at the initial stage allowed us to define the readiness level of pre-service TESOL teachers towards developing and using multimedia-based textbooks in aspects of technical and methodological competences in the regarded area, identify the degree of understanding of the importance and significance of the application of multimedia-based educational products to achieve new academic results, the level of their motivation for the development and implementation of multimedia-based textbooks and their aspirations for self-development in the denoted field. The data obtained also allowed us to define the problems and raise the potential level of TESOL teachers' readiness to develop and use multimedia-based textbooks.

The results of the pre-test stage proved that the theoretical basis and practical mastery of the majority of participants corresponded to the insufficient level of TESOL teachers' readiness to develop and use multimedia-based textbook which entailed the necessity of implementation of the experimental course intended to compensate for the gaps and solve the defined problems preventing participants from successfully developing multimedia educational resources. The course suggested and conducted in the experimental group enabled the significant growth of TESOL teachers' readiness to develop and use multimedia-based textbooks which gave us the reasons to conclude that the tasks set out in the present study were fulfilled. The course organized in three stages (theoretical, practical and professionally-oriented) was designed in accordance with the results of the pre-test phase which served as the basis for identifying the content that contributed to the efficient strategy of raising TESOL teachers' readiness to develop and use multimedia-based textbooks.

The research results permitted us to understand the problems of assessing the TESOL teachers' perception of their readiness to develop and use multimedia-based textbook in term of their dimensions formed which in complex form represented the integrative quality of a teacher able to efficiently implement multimedia technologies into his professional activity. The results of the study can be of interest for further and broader investigations of the methodological and pedagogical aspects of developing multimedia-based textbook in regard to including them in the course of teacher s' professional training.

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