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Designing a Combined Learning model in Technical and Vocational education

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Abstract

Purpose: The aim of this study was to design a combination learning model in technical and vocational education.

Methodology: This study was applied in terms of purpose and exploratory (quantitative and qualitative) in terms of implementation method. The research population was in the qualitative part of documents and resources and specialists in the field of combined learning and in the quantitative part were the principals and students of technical and vocational schools in Zanjan province in the academic year 2018-19. The sample of research was in the qualitative part of documents and resources related to combined learning and 17 experts in the field of learning who were selected according to the principle of theoretical saturation by sampling method of network experts and in the quantitative part were 176 administrators and students who according to Krejcie and Morgan table with Cluster sampling method was selected. Data were collected by filing methods, interviews and a researcher-made questionnaire (39 items) whose face and content validity of the questionnaire was confirmed and its reliability was obtained by Cronbach's alpha method of 0.81. Qualitative data were analyzed by open and axial coding method based on Klein model and quantitative data were analyzed by Delphi methods to determine the validation of the model and t-test.

Finding: The results showed that combined learning in technical and vocational education included 43 basic concepts and 9 structural concepts including learning objectives, learning content, learning activities, learning strategies, grouping, learning materials and resources, learning time, learning location and evaluation. The combined learning model of design and its validity by experts with Delphi method was approved in two stages and the number of basic concepts was reduced from 43 to 39. The results of t-test also showed that technical readiness and readiness of human factors combined learning had an effective role in technical and vocational education.

Discussion: According to the results, the designed model of combined learning approved by experts can be used in combined learning environments in technical and professional organizations and can be a criterion for future research in this organization.

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1. Introduction

The technical and vocational education system, as one of the important components of the education system of countries, is one of the managers of efficient and effective manpower training, and the role of this system is critical compared to the theoretical education system that provides manpower before university (Korber Oesch, 2019). The system of technical and vocational education has been established with special objectives such as guiding learners to employment and continuing education, and countries that have made the quality of the technical and vocational education system the focus of their core missions and focus on technical and vocational education as basic policies. They considered efficient human beings to be more developed (Chaharband, 2010). Along with paying attention and investing in the technical and professional system, paying attention to the learning and teaching process of students has also been one of the policies of developed countries (Hassanifandik et al., 2016).

In recent years, new changes and innovations in the world education curriculum have provided countless educational opportunities for learners; So that they can learn in face-to-face classrooms with online training courses, using tools such as blogs, virtual classrooms, discussion boards and forums, which are called combined learning (Ajam, 2015). There are usually three methods of traditional, electronic and combined education. Traditional education is the same as face-to-face education and the emotional connection between the teacher and the learner, which no longer meets the high volume of demand for education in the information-driven society. E-learning refers to the use of information and communication technologies without the element of emotional communication, although this training is successful in achieving goals due to lack of time and space, but in achieving the desired goals and quality of learning due to non-interaction problems. Human, emotional and face-to-face communication in the classroom, lack of proper understanding of educational cyberspace, delays in feedback, delays in asynchronous learning and lack of motivation to read online electronic content have not been successful. Due to the weaknesses of both traditional and electronic methods, educational specialists combined the features and strengths of the two methods to create a method called combined teaching and learning (Najafi, 2017). In general, the term blended learning refers to the third generation of education systems that aims to maximize the benefits of face-to-face learning and multiple technologies, so it is a dynamic, responsive and evolving process that is pedagogically the basis for process design and development. Teaching and learning are considered (Li et al, 2019). Thus, combined learning can be defined as a combination of classroom and e-learning, which has the feature of comfort and convenience of e-classrooms and to some extent retains the features of traditional education (Chmiel, et al, 2017).

Combined learning was first introduced in Scandinavia and later in the United States, Europe, and elsewhere, but this teaching method was formally first introduced by Marsh in 2003 (Boelens, et al, 2018). Some educators have defined blended learning as a combination of traditional and electronic methods, while others have defined it as an appropriate approach to achieve the desired learning objectives using appropriate technologies and attention to individual differences (Ellis et al, 2016). In a more comprehensive definition, combined learning combines four methods of web-based technology to achieve educational goals, combining a variety of pedagogical approaches to optimally produce learning outputs with or without technology, combining any form of educational technology with face-to-face and teacher-centered training, and combining educational technology with Job duties are defined (Romadhon, et al, 2019).

Blended learning has many benefits, the most important of which are flexibility in designing and producing different learning resources, enhancing the diversity of learning styles, enhancing diverse e-learning experiences and opportunities, and delivering quality learning by focusing on the harmony and balance of the education system (Park et, al, 2016). A study in the United Kingdom found that 94% of teachers believe that a combination of online and traditional teaching is more effective than the traditional method, and 85% believe that combined teaching is an important tool to improve the quality of learning (Catalano, 2014). Combined education reduces fifty percent of educational time and costs, increases

educational outcomes by ten percent, increases responsibility, social collaboration, improve self-confidence and intrinsic motivation and self-efficacy in learners (Han, Ellis, 2019). It can also increase learners' learning and interaction, improve accessibility and flexibility in content production and presentation, and improve organizational requirements and commitments in the teaching-learning process (Alshehri, 2017). Combined learning due to the improvement of the educational process, increased access to educational documents and resources and flexibility in the time and place of education, higher efficiency than costs compared to the virtual method alone, enrichment of learners' experiences in the educational space and increase learning and student satisfaction (Vanslambrouck, et al, 2018).

Very little research has been done on blended learning, especially in the country. For example, Mirmoghtadaie and Ahmady (2019) in a study concluded that combined learning had 5 levels and 40 subclasses, which included student competencies, teacher competencies, technical aspects, pedagogical field and supportive environment. The results of Najafi (2017) showed that the situation of dimensions and indicators of combined learning and quality of learning is appropriate and learning combined and three dimensions of pedagogy, technology and learning style affect learning, but methodology did not affect learning. In another study, Savari and Falahi (2017) reported that blended learning has the benefits of both traditional and e-learning approaches and is an effective approach to increase the effectiveness of learning, ease of access to educational materials and increase the effectiveness of costs. Also, due to providing different opportunities for learning, this method causes to pay attention to individual differences along with increasing the attractiveness of education. Ajam (2015) while conducting a study concluded that faculty members agree with the combined view of learning at Payame Noor University and although there is a difference between their views in terms of gender, but between their views in terms of degree, teaching background and skills There was no difference between computers. In addition, the results of Karami and Salari (2013) showed that the level of learners 'satisfaction and experts' learning in the combined learning environment is significantly higher than the traditional learning environment. In another study, Seyedi and Yaghoubi (2012) reported that combined learning included eight dimensions: organizational, educational, technological, design, evaluation, management, support resources, and ethics. Also, Li et al (2019) while researching concluded that combined learning had an effective role in improving knowledge, skills and academic satisfaction in students. In another study, Colasante and Hall Vanden Elsen (2017) designed a hybrid learning model in technical and vocational education that included three elements of active learning, interactive learning, and online communication, with a strong emphasis on faculty presence. The results of Mwanza-Simwami (2016) showed that the combined approach is more effective than traditional and electronic approaches alone. Ardid et al (2015) introduced the dimensions of combined learning including pedagogy, technology, learning style and methodology. In addition, Glazer (2012) introduces blended learning for technical and vocational education including weekly elements of diverse training, active learning, increasing time, being active in the online classroom, the importance of face-to-face presence, responsibility for learning and organizing knowledge, and subject layering. کرد. Khan (2007) emphasized the eight dimensions of pedagogy, technology, evaluation, design, management, support resources, ethics, and institution in designing hybrid learning. Akker (2003) introduced a blended learning model in higher education including characteristics of objectives, content, teaching and learning strategies, teaching and learning activities, learning materials and resources, grouping, time and place of learning and evaluation.

Combined learning in the technical and vocational education system provides a kind of learning method that raises the level of educators and students and connects them to global classrooms (Thorne, 2003). Also, although blended learning can provide the benefits of both traditional and virtual methods, it is a good way to achieve teaching-learning goals in education, but few studies have examined its different angles and no model research for blended learning in schools, especially education. It is not technically and professionally designed. Before judging the effectiveness of a learning model, one must first design an appropriate model. Therefore, it is necessary to design a combined learning model of society in the system of technical and

vocational education to be appropriate to the conditions and educational system of our country, Iran. Therefore, considering the role, importance and effectiveness of blended learning, the complexity of the technical and vocational education system, deep understanding of the dimensions and components affecting blended learning in this educational system and providing an appropriate model, the present study aims to design a blended learning model in technical education. And a profession was done.

2. Methodology

This study was an exploratory mix (quantitative and qualitative) in terms of applied purpose and in terms of implementation method. Exploratory mixed method is a method that is performed using a combination of quantitative and qualitative methods and in the collection sequence, first qualitative data and information are collected and then quantitatively. The research population was in the qualitative part of documents and resources and specialists in the field of combined learning and in the quantitative part were the principals and students of technical and vocational schools in Zanjan province in the academic year 2018-19. The sample of research was in the qualitative part of documents and resources related to combined learning and 17 experts in the field of learning who were selected according to the principle of theoretical saturation by sampling method of network of experts and in the quantitative part were 176 managers and students. Cluster sampling method was selected. Criteria for selecting specialists 10 years of experience in teaching e-learning, writing several books in the field of learning and teaching and having 5 scientific research articles in this field.

In this research, the basics, constituent elements and characteristics of the elements were identified using the library method and the theoretical method using phishing methods and then the combined learning model was designed based on Klein model and its validity was evaluated by experts from Delphi method in two stages. In other words, in the qualitative section, using the library method and reviewing the literature and research background, the use of Internet resources, reading articles related to blended learning and blended learning patterns were reviewed. Then, the studied studies were opened to the elements with messages and paragraphs with concepts related to research, coding, and a number of basic concepts (characteristics of elements) and structural concepts (elements) were identified. He became a technician and a professional. The model designed by Delphi method was then approved by 17 experts in the field of combined learning in two stages via e-mail and telephone interviews.

At the end of the qualitative part, the quantitative part was started and the quantitative part data were collected using a researcher-made combined learning questionnaire. This questionnaire has 39 items and 9 components of learning objectives (3 items), learning content (5 items), learning activities (6 items), learning strategies (4 items), grouping (4 items), learning materials and resources (5 items) , Learning time (2 items), place of learning (2 items) and evaluation (8 items) and two general dimensions of technical readiness (17 items) and readiness of human factors (22 items). In this tool, items are scored using a five-point Likert scale (1 = very low to 5 = very high), so the total score range of the tool is between 39 and 195. Also, its face and content validity was confirmed and its reliability was obtained by retest method of 0.77 and Cronbach's alpha method of 0.81. In this section, the level of technical readiness (infrastructure including access to computers and the Internet, appropriate bandwidth, support, etc.) and the readiness of human factors (learners, teachers and other executive agents) of the combined learning model in technical and vocational education with the aim of feasibility were determined. To analyze the data in the qualitative part, open and axial coding method according to Klein model was used and in the quantitative part, Delphi methods were used to determine the validation of the model and t-test in SPSS software version 23.

3. Findings

Theoretical method according to Klein's model was used to identify the basics, elements and features of the combined learning model. Therefore, according to this method for designing a combination learning model, approaches and theories of learning behaviorism, cognition, personal constructivism and social constructivism are examined and according to it, the combination learning model is identified and then by reviewing all documents and resources related to blended learning in books, journals. Scientific and databases, the basic concepts or the characteristics of the elements that make up the combined learning and structural concepts were identified and thus the combined learning model was presented based on the Klein model in technical and vocational education. As a result, Table 1 presents the basics of blended learning in technical and vocational education, taking into account the focus of the blended learning approach.

Table1. Focus and focal points of the combined learning pattern

focal point	Attributes
Mutual and interactive application of online and face-to-face learning	Benefit from all the facilities of face-to-face and online learning in designing and implementing the curriculum
Use multiple learning resources	Use online learning resources and printed written resources
Real and online social interactions	Learners' interaction with teachers and other learners in the classroom and in the online learning environment, the development of multiple interactions through the use of various online and face-to-face learning facilities
Utilizing learning strategies in both environments and paying attention to individual differences	Enabling learners to use a variety of face-to-face and online learning strategies and thus fit their different learning styles
Supports learning diversity	Expanding the scope of learners' learning activities and the possibility of working in the web and in-person environment
Benefit from diverse learning experiences	Learners' experience in face-to-face and online learning environments
Enriched active learning	Motivate active learning in the classroom by instructors and active participation of learners in the online environment and better understanding of learning content
Expand the topics in the classroom in the online learning environment and vice versa	Explaining the course content by the instructor in the classroom and extending the class topics to the online learning environment and the learners' interaction with the content and other learners in the online environment
Development of self-directed learning	Helping the teacher to prepare for self-directed learning in the classroom and continuing self-directed learning activities online
Flexible access to the tutor	Learners' access to teachers in the school and classroom environment and access to teachers and classmates in the online learning environment
Flexibility of learning time and place	Learners can learn both in school and online and have no time limit.
Benefit from extensive feedback and tips	Learners can benefit from instructors' guidance in person and receive clear feedback about learning. It is also possible to receive guidance and feedback from instructors and learners at any time and place through online tools.
Variety in evaluation methods and methods	Due to the nature of the subject under study and the differences of learners, it is possible to use face-to-face and online evaluation

Reviewing the theoretical foundations of blended learning, it was found that in addition to the focus of blended learning, to identify the basics of the blended learning model, the characteristics of learning theories should also be examined. As a result, Table 2 presents the characteristics of learning theories of behaviorism, cognition, personal constructivism, and social constructivism.

Table2. Characteristics of learning theories in the combined learning model

Learning theories	characteristics
Behavioral theory	The role of environment, emphasis on environmental factors and the relationship between stimulus and response, use of behavioral goals, practice and reinforcement, lesson plan, content analysis and simplification, specific and detailed instruction in linear order, presentation of educational content from simple to complex Arranging stimulus presentation and reviewing learning effects, using electronic tools such as computers and multiple choice tests (first level of combined learning approach), monitoring learning, providing feedback and evaluation
Cognitive theory	Paying attention to the role of internal mental processes such as memory, how to receive, acquire, process, maintain, retrieve, recall information, attention, concept learning, problem solving and reasoning, searching for principles and relationships in processing new information and adapting it to previous knowledge, understanding concepts And the relationship between them in face-to-face and e-learning environments, turning the learning task into different steps to attract the learner's attention, using CDs and teaching based on multimedia and educational software (first level of combined learning approach), information classification, information reconstruction, attention To prioritize, encourage the long-term maintenance and transmission of the studied content and the teacher as an instructor
The theory of personal constructivism	Construction of knowledge by the learner (learner-centered) and personally in the context of the text and context, attention to the role of learner activity not the learning process, creation of unique learning experiences, asynchronous nature of learning (second level of combined learning approach), control over place and time of learning Relative, emphasis on learning contexts and environments is not a predetermined learning process; گیری Using asynchronous online communication with learning content and electronic and printed texts
Theory of social constructivism	Building individual and social knowledge through interaction with the social environment of learning and interaction and cooperation in the group, paying attention to the values acquired through the community, emphasizing the uniqueness of each learner, using face-to-face and online curriculum simultaneously and asynchronously (third level approach Combined learning), the possibility of learners' social interaction with each other and the formation of a learning community, a dynamic and continuous group process between learners and teachers, collaborative learning, the use of multimedia tools such as online video conferencing, virtual classes, text, audio and video forums, knowledge building Individual and social reconstruction by learners based on their interpretation of the context and context of the real world, emphasis on the approximate area of growth, growth of learner's intellectual ability to help peers and adults, rooted knowledge in social interaction through language, multiple learners interactions with each other Under the simultaneous guidance of the instructor in traditional face-to-face and online environments, knowledge building by listening and learners' group discussions with the instructor and others, the active role of learners in constructing meaning, presenting small lectures by the instructor and promoting Group discussion, instructor support for multiple face-to-face and online interactions between learners and collective analysis, search and research

According to the focus of combined learning and the characteristics of different learning theories about this learning method, the basics of the combined learning model in technical and vocational education based on the Klein model were presented in Figure 1.

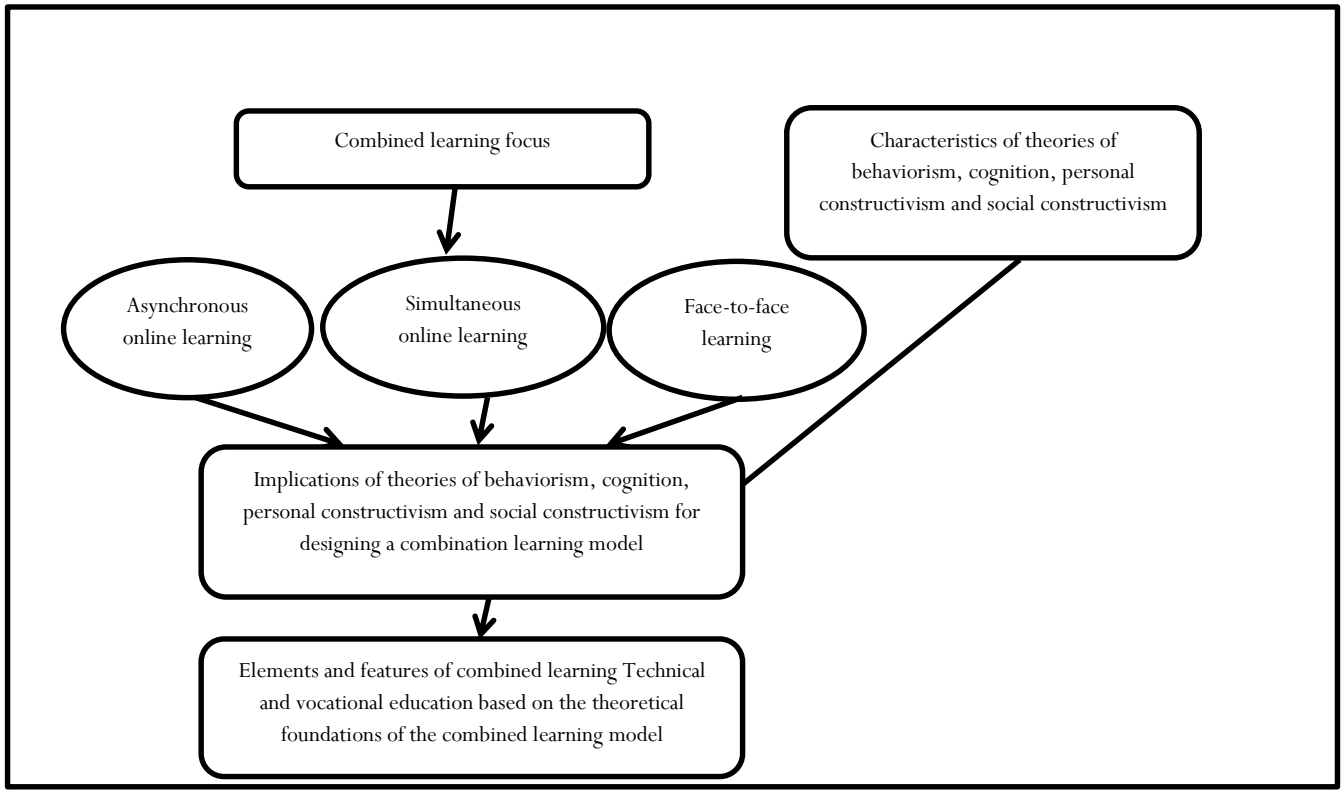

Figure1. Basics of hybrid learning model in technical and vocational education based on Klein model

According to the results, the combined learning model in technical and vocational education based on the Klein model consists of a set of face-to-face, simultaneous online and asynchronous online learning in which the focus of combined learning and the indicators of different learning theories are considered. The results of open coding to identify the main concepts and sub-categories of the combined learning model in technical and vocational education are presented in Table 3.

Table3. Open coding results to identify the main concepts and sub-categories of the combined learning model in technical and vocational education

The main concepts	Subcategories
Thematic layering	Gaining the ability to use cyberspace and face-to-face to link learning and practice and establish a relationship between the work environment and education, establish coordination between different stages in designing face-to-face training courses with simultaneous (online) and non-simultaneous (offline) training
Learning activities	Personalize education (face-to-face or virtual) according to the learning capacity of each person, having a frequency of searching in the classroom, self-learning through educational CDs and e-books and written textbooks or school instructions
Online learning	Holding debugging classes by instructors through the Internet online, sending books, pamphlets and educational CDs necessary for learners to hold relevant exams through the correspondence system, preparing educational materials and electronic content and presenting it through the Internet and the site
Interactive and group learning	Familiarity and acceptance of the culture of using online conversations, tips and communication, heartfelt comments and, organizing face-to-face classes and providing content and educational materials in practical trainings
Traditional education	Designing face-to-face training courses in the organization, conducting face-to-face trainings to present theoretical topics, holding training classes and troubleshooting by instructors (offline), matching non-simultaneous virtual training methods (offline) with the content of the courses

Various educational methods	Utilization of virtual and written content archive, utilization of resources, equipment and educational facilities for self-learning of learners, utilization of virtual and written content at any time and place to acquire knowledge and skills, utilization of cyberspace and electronic and multimedia databases, utilization of instructors And experienced trainers equipped with up-to-date knowledge and benefiting from virtual and face-to-face laboratories
Learning conditions	Holding practice and debugging classes by instructors in person, on the web in job groups in the form of virtual trainings, conducting face-to-face training courses at appropriate times according to the working hours of individuals, preparing a calendar of face-to-face trainings for annual training programs
learning goals	Acquisition of independent learning skills (theoretical and practical topics) for lifelong learning, acquisition of skills to use any time and place to get acquainted with the real work environment and acquisition of self-assessment skills to adapt to new needs arising from external environmental changes
assessment	Assessing the extent to which learners achieve self-learning skills, assessing the ability to communicate with others in cyberspace and in person, assessing the amount of content learned at the end of the course, assessing the level of familiarity and adaptation of learners' learning with real work environment, assessing the skill of using virtual environments And presence for learning, measuring learners 'beliefs and attitudes at the end of training, using different evaluation methods (written, virtual, practical, etc.), evaluating the amount of content learned during learning and evaluating learners' self-assessment skills at the end of training courses
Learning content	The content of the courses is appropriate to the learners 'self-learning, there is coordination between the participants' scientific level and self-learning in education, the ability to design and produce educational CDs and present it in the form of software and educational slides (PowerPoint)

According to the results of Table 3, 10 main concepts for the combined learning model in technical and vocational education including thematic layering, learning activities, online learning, interactive and group learning, traditional education, various teaching methods, learning conditions, learning objectives and evaluation were identified. Axial coding method was used to understand the relationships and proportions of concepts, so the results of axial coding to identify structural concepts (constituent elements) and basic concepts (characteristics of constituent elements) combined learning model in technical and vocational education based on Klein model were presented in Table 4.

Table4. Axial coding results to identify the structural and basic concepts of the combined learning model in technical and vocational education based on the Klein model

Structural concepts	basic concepts
learning goals	1. Acquiring theoretical and practical independent learning skills for lifelong learning, 2. Acquiring the ability to communicate with others in cyberspace and in person for teamwork, 3. Acquiring self-assessment skills to adapt new needs to environmental developments, 4. Acquiring the skill of using any Time and place to get acquainted with the real work environment and 5. Gain the ability to use cyberspace and face-to-face to link learning and practice and establish a relationship between education and the work environment
Learning content	1. Proportion of course content with learners 'self-learning, 2. Placing important content and assignments on the site for practice and learning, 3. Coordination between learners' academic level and self-learning in training courses, 4. Preparation of educational materials and electronic content and its online presentation and 5 Ability to design educational CDs and present it in the form of software and educational slides (PowerPoint)
Learning activities	1. Designing face-to-face training courses in the organization, 2. Having the skill of searching for a subject in the field of specialization in databases, 3. Self-learning through educational CDs and e-books, 4. Holding debugging classes by instructors online, 5 The appropriateness of offline virtual education methods with the content of the courses, 6. Sending books, pamphlets and educational documents for learners to hold exams, 7. Holding training classes and troubleshooting by instructors offline
Learning strategies	1. Establishing coordination between different stages of face-to-face training courses with online and offline trainings, 2. Personalizing face-to-face and virtual training according to each person's learning capacity, 3. Presenting all training content in virtual class and 4. Implementing face-to-face trainings for theoretical topics
Grouping	1. Familiarity and acceptance of the culture of using online conversations, 2. Creating groups and Internet connections for discussion and exchange of views, 3. Forming face-to-face classes and providing content and educational materials, and 4. Benefiting from the archive of virtual and written content

Learning materials and resources	1. Utilizing educational resources, equipment and facilities for self-learning, 2. Utilizing virtual and written content at any time and place to acquire knowledge and skills, 3. Utilizing virtual, electronic and multimedia databases, 4. Utilizing instructors and Experienced instructors and equipped with up-to-date knowledge and 5. Beneficiaries of virtual and face-to-face laboratories
Learning time	1. Execution of face-to-face training courses at the appropriate time and 2. Preparation of a calendar of face-to-face trainings for the implementation of annual training programs
Learning place	1. Holding practice and debugging classes by instructors in person and 2. Creating a dedicated website in different groups to implement virtual training
assessment	1. Evaluate the extent to which learners achieve self-learning skills, 2. Evaluate the ability to communicate with others in cyberspace and in person, 3. Evaluate the level of content at the end of the learning period, 4. Evaluate the extent of familiarity and adaptation of learners' learning to real work environment, 5 Evaluating the skill level of using virtual and face-to-face learning environments, 6. Assessing learners' beliefs and attitudes at the end of the training, 7. Using different methods of evaluating self-learning training courses, 8. Evaluating the amount of content learned during learning and 9. Evaluating self-assessment skills Learners at the end of training courses

According to the results of Table 4, the combined learning model in technical and vocational education based on Klein model includes 43 basic concepts (characteristics of constituent elements) and 9 structural concepts (constituent elements) including learning objectives (5 basic concepts), learning content (5 basic concepts) Learning activities (7 basic concepts), learning strategies (4 basic concepts), grouping (4 basic concepts), learning materials and resources (5 basic concepts), learning time (2 basic concepts), place of learning (2 basic concepts) and Evaluation (9 basic concepts). Therefore, the conceptual model of combined learning in technical and vocational education based on Klein model is presented in Figure 2.

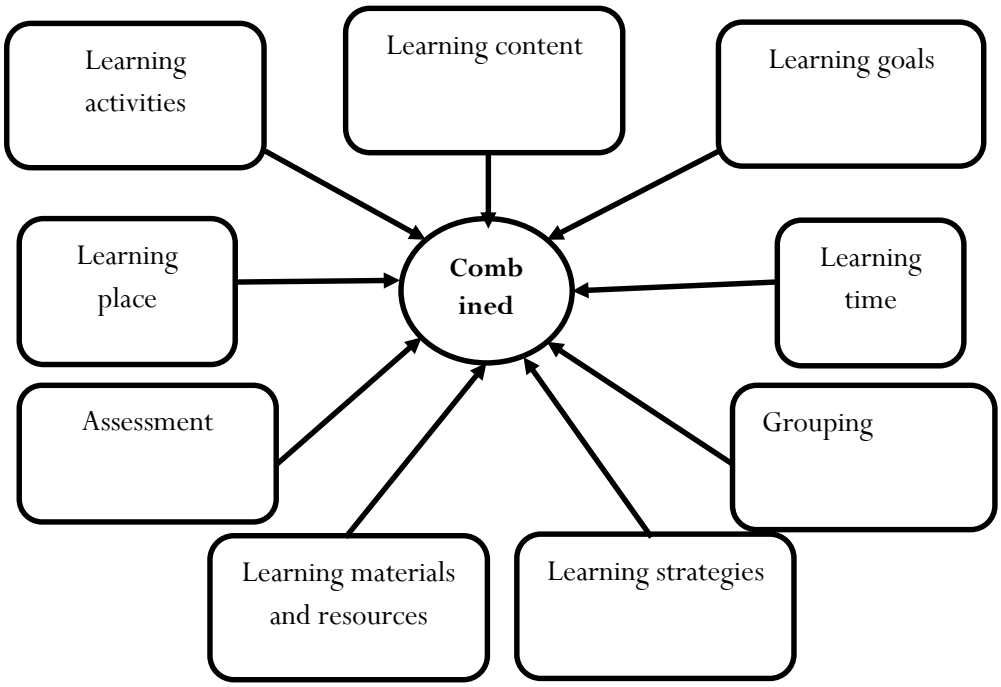

Figure2. Conceptual model of combined learning in technical and vocational education based on Klein model

The validity of the combined learning model in technical and vocational education based on the Klein model was confirmed by 17 experts by Delphi method in two stages and the number of concepts was reduced from 43 to 39 (concepts of self-assessment skills to adapt to new needs with environmental changes, having The ability to search for a subject in a specialized field in databases, the relevance of offline virtual learning methods to the content of courses, and the evaluation of the ability to communicate with others in cyberspace and in person were eliminated or merged with other concepts); So that the Kendall coefficient calculated in

the first stage was 0.631 and in the second stage was 0.733, which is acceptable because it is higher than 0.7. To identify the state of technical readiness and readiness of human factors, the combined learning model in technical and vocational education was used as a one-sample t-test, the results of which are presented in Table 5.

Table5. Results of one-sample t-test to identify the state of technical readiness and readiness of human factors, combined learning model in technical and vocational education

Variables	Kolmogorov-Smirnov	meaningful	The difference between the means	T	DF	meaningful
Technical readiness	0/99	0/61	-117/69	-161/36	175	0/001
Preparation of human factors	0/99	0/50	-98/82	-87/14	175	0/001

According to the results of Table 5, both technical readiness (infrastructure including computer and Internet access, appropriate bandwidth, support, etc.) and readiness of human factors (learners, teachers and other executive agents) play an effective role in the combined learning model in technical education and they have a profession.

4. Discussion

Combined learning in the system of technical and vocational education raises the level of educators and students and there is no model for it in the system of technical and vocational education, therefore, the present study was conducted to design a model of combined learning in technical and vocational education.

Findings of the present study showed that combined learning in technical and vocational education had 43 basic concepts and 9 structural concepts including learning objectives, learning content, learning activities, learning strategies, grouping, learning materials and resources, learning time, learning location and evaluation. The model designed according to 8 structural concepts was approved by experts by Delphi method. Other results showed that technical readiness and readiness of human factors combined learning had an effective role in technical and vocational education. These results are in line with the results of research of Mirmoghtadaie, Ahmady (2019), Najafi (2017), Savari and Falahi (2017), Ajam (2015), Karami and Salari (2013), Seyedi, Yaghoubi (2012), Li et al (2019).), Colasante Hall Vanden, Elsen (2017), Mwanza-Simwami (2016), Ardid et al (2015), Glazer (2012), Khan (2007) and Akker (2003) were consistent. For example, Mirmoghtadaie, Ahmady (2019) while conducting research concluded that combined learning had 5 levels and 40 subclasses, which included student competencies, teacher competencies, technical aspects, pedagogical field and supportive environment. In another study, Seyedi, Yaghoubi (2012) reported that combined learning included eight dimensions: organizational, educational, technological, design, evaluation, management, support resources, and ethics. Also, Colasante Hall Vanden, Elsen (2017) designed a combined learning model in technical and vocational education that included three elements of active learning, interactive learning and online communication, and in this model, the presence of professors was emphasized. Ardid et al (2015) introduced the dimensions of combined learning including pedagogy, technology, learning style and methodology. In addition, Glazer (2012) introduces hybrid learning for technical and vocational education, including weekly elements of diverse education, active learning, increasing time, being active in the online classroom, the importance of face-to-face attendance, responsibility for learning and organizing knowledge, and subject layering. Khan (2007) emphasized the eight dimensions of pedagogy, technology, evaluation, design, management, support resources, ethics, and institution in designing hybrid learning.

In describing the results, it can be said that blended learning is an approach that combines traditional forms of classroom learning such as efficiency and opportunities for simultaneous and asynchronous interaction, participation and socialization of the classroom with various e-learning events and activities and enriched online learning facilities, including interactions, Combines simultaneously and asynchronously. Thus, combined learning combines the strengths of both face-to-face teaching methods and online learning,

and presents teaching and learning activities in a simultaneous and asynchronous manner in terms of the type of presentation. In this study, four approaches of behaviorism, cognition, personal constructivism and social constructivism in combined learning were emphasized. Behaviorism approach in blended learning emphasizes the use of behavioral goals, reinforcement, lesson plan, content analysis and simplification, and what needs to be taught in this approach is precisely defined and then its components are presented in linear order with feedback and no the part is not taught until complete mastery of the previous components. The cognitive approach to combined learning emphasizes the internal processes of the mind and schemas as a knowledge-organizing structure. In the personal constructivist approach, the emphasis is not on teaching, but on the context or environment of learning, and learners construct experiences and learning through asynchronous online communication with learning content and electronic and printed texts. In the social constructivist approach, learners construct their knowledge through interaction with the learning environment and interaction between group members.

Also, in explaining the nine structural concepts of combined learning in technical and vocational education, it can be said that the main missions of the technical and vocational education system are achieved in the light of achieving its specific goals. Because the hybrid learning pattern is implemented with the aim of making changes in the behavior of learners and these changes are the same goals of the learning pattern. Goals are determined by active participation between the instructor and the learner and there are no pre-determined goals for the combined learning program, and learning goals determine the orientation of the learning process and are the criteria for learning success. Content that should be considered in technical and vocational education should be based on inclusive interests and their effective involvement, and real learning occurs only when the learner personally strives to organize the learning content in order to create a specific meaning and concept of the content. In the combined learning method, the concepts of presenting the course materials lose their meaning logically and with breadth and sequence and give way to the concepts of composition and integration. Also, learning activities should be selected in a way that motivates the technical and professional students to learn and is selected and planned by them in consultation with the instructors. Although learning activities are not designed in a hybrid model to achieve predetermined goals, they should guide learners to the goal and include activities that encourage students to engage effectively and actively. Learning strategies are an integral part of learning activities, and technical and vocational instructors use appropriate methods to help students achieve content and goals faster. In the combined learning model, instructors are the partners of the learners and facilitators of the teaching-learning process, who choose appropriate strategies for teaching. In addition, the grouping of learners helps to provide the training environment and meet the needs of students in a desirable way. Grouping requires flexibility and the interests and needs of learners must be taken into account. Learning materials and resources should be provided to learners on the basis of selected learning content in an organized manner, and they are broadly defined in terms of whatever the learner needs to learn. In blended learning, books are usually of little value and instead focus on a wide variety of learning materials and resources, such as cyberspace, electronic, and multimedia databases, which give the learner the opportunity to explore and organize learning. Also, learning time is not predetermined and is flexible. How and how to use time for the benefit of the goals is the responsibility of the learners and learning is not limited to a specific time, such as attending class, and learning may occur at any time. The place of learning is not as predetermined as the time of learning and is flexible. Of course, there is a classroom as the central space where teaching takes place, but the combined learning process requires learners to take advantage of many places and facilities for learning. In addition, evaluation is considered as an effort between the instructor and the learner in the combined learning model of technical and vocational education. Self-assessment is an important process in this model, and the evaluation of the learning process that learners do is no less important than the evaluation of the end product of learning.

In addition, in describing the effective role of technical readiness and readiness of human factors, combined learning in technical and vocational education can be said that attention to technical readiness, ie infrastructure including access to computers and the Internet, adequate bandwidth, support, etc. is one of the factors that determine Was involved in the successful implementation of the hybrid learning model. Educational materials and resources that in multimedia learning environments is more networked and interactive to a wider range of information content in their field. Congresses are e-information facilities that are of particular importance in influencing the blended learning model in technical and vocational education, so technical readiness or infrastructure in achieving the goals and mission of the blended learning approach in technical and vocational education should be considered. Also, paying attention to human factors including learners, teachers and other executive factors that somehow play a role in the process of combined learning are effective in the success of the combined learning model in technical and vocational education. Because this learning pattern is a process between the instructor and the learner to increase knowledge and technical and professional skills and the quality of this process is the optimal state of education in which the phenomenon of learning occurs in students and the instructor is committed to effective conditions.

In general, the results showed that the combined learning model in technical and vocational education had nine structural meanings including learning objectives, learning content, learning activities, learning strategies, grouping, learning materials and resources, learning time, place of learning and evaluation. It was approved by experts and the two dimensions of this model, namely technical readiness and readiness of human factors, played an effective role in the combined learning of technical and vocational education. One of the limitations of the research is the existence of small (especially internal) researches about combined learning, low cooperation of some teachers and learners to participate in the research and use of self-report tools for data collection. Because people may not have enough self-control when completing it and do not respond responsibly to statements. However, in this study, an attempt was made to neutralize the effect of this limitation by stating the purpose, importance and necessity of the research and conducting the analysis in general. Therefore, it is suggested that more research be done on the role of technical readiness and human factors of the combined learning model in technical and vocational education and even theoretical education and compare the results with the results of the present study. According to the results, it is recommended that the model of the combined learning model be considered by experts and curriculum planners of technical and vocational schools and use it to improve the process and quality of learning. Another important point is that the officials and those in charge of the education system, including technical and vocational education, should take steps towards the use and application of a curriculum based on combined learning to help improve the quality of learning in line with global developments in the use of new innovations in education and learning. In addition, the current research model can be used by education officials and teachers and, given its appropriate validity, can be a criterion for future research in this organization and even other educational organizations.

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