



Designing a Reverse Learning Model and Investigating the Effectiveness of the Created Educational Program on Academic Engagement and the Sense of Belonging to School of Senior High School Students

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Abstract

Considering the recent change in teaching methods from teacher-centered to student-centered, and the existence of a gap in student-centered education models, this research aimed to design a reverse learning model and investigate the effectiveness of the resulted educational program on the academic engagement and the sense of belonging to the school of the senior high school students. The research was developmental in nature, with a sequential exploratory mixed-method design adopting meta-synthesis and quasi-experimental approach. The research scope included all scientific articles and documents published from 2011 to 2021. The validity of the articles was checked via the CASP, the validity and reliability of the meta-synthesis was checked by the Laushe and the Scott's pi tests respectively. Finally, to implement the educational intervention, 40 male and female senior high school students of Bukan were selected by standardized random sampling method and assigned to two groups of experimental and control. The research instruments included Rio's academic engagement questionnaire (2013), Brown and Evans' (2002) sense of belonging to school questionnaire as well as the researcher designed reverse learning package. Based on the meta-synthesis of the related studies, 4 categories, 8 concepts, and 23 codes for reverse learning were discovered, labeled, and confirmed based on which, a training package was designed and implemented in 10 sessions of 45 minutes. The results showed that reverse learning model has a positive and significant effect on students' academic engagement and belonging to school ($\text{sig} < 0.05$). Therefore, it can be concluded that reverse learning model, as the one proposed in this study, can be used as a framework to improve academic engagement and sense of belonging to school of students.

Keywords: Academic engagement, Belonging to school, Reverse learning

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Introduction

In today's world, every one needs education and learning, and learning is considered a part of human life.

Therefore, the focus of all curriculum and educational programs is on the realization of learning, and until today, no subject has transformed education as much as

learning and its related issues. In the past decades, when there was limited access to information, the teaching-learning method used focused on memorizing and linking information with each other and building new findings, but now that the amount of information accessible is abundant, traditional methods can be less effective for the current mass information (Kaviani et al., 2018).

In addition, an effective factor for changing the traditional way of learning is the expectation from the learner. In other words, emphasis on higher cognitive abilities and efficient learning strategies is another factor of change in the learning method (Edraniya & Dibai, 2019). Based on this, it is necessary for the teaching and learning processes to be coordinated with these developments and to move from the traditional strategies of information transfer to new problem-solving educational strategies that will lead to the growth of creative abilities in learners (Khalaf, 2018). In this regard, the reverse or flipped teaching method, which is a new teaching and learning approach based on information and communication technology, has changed the concepts of teaching and learning in the traditional classroom in a creative way (O'Flaherty & Phillips, 2015) and is one of the most popular models of strengthening learning in the 20th century (Johnson et al., 2015).

There are various models for educational design, and the model that governs our schools is mostly based on the curriculum model concerning academic subjects and scientific disciplines. The curriculum in such a model is exactly divided into course materials, which are often divided into sub-parts based on classrooms, curriculum, grading and finally evaluation of the course and academic progress report (Sadeghi & Mahmoudi, 2018). The reverse learning method will affect the students' expectations in a way that they interact in the classroom, therefore, this method and the influential indicators in their formation help improve the teaching process, and the effect of this program can be the legacy of the education for the students throughout their life. The model based on academic subjects and scientific fields over time turns knowledge transfer into the main teaching mission of a teacher, and face the development of students' individual capabilities in cognitive, skill, and attitudinal fields with some problems, and an educational vacuum is felt in these educational systems. Another teaching method is the reverse teaching method, which is considered one of the new teaching methods in the educational system, and until now, a study has not been done to investigate its effectiveness in a coherent and purposeful way and designing a model is necessary in this regard.

Reverse learning is one of the new teaching methods today. In the 21st century, Seamless Flipped Learning has become the main part of teaching in universities and schools (Mortensen & Nicholson, 2015). This learning method has become very important in the current situation (coronavirus outbreak) (Sahibyar et al., 2021). Hung stated that when the learners experience flipped learning, they consciously experiences learning in a combination of places, times and technologies, without borders (Hwang, Lai & Wang, 2015). Milard also said that seamless flipped learning can provide continuous learning experience in different environments such as home, school, university, or workplace (Milard et al., 2013). In integrated reverse learning, the learners during learning activities can review and evaluate their understanding of subjects with the help of the teacher or classmates. In this way, they can correct their misunderstandings, which can help improve the student's awareness (Limueco & Prudente, 2019). In flipped classes, we will see less time shortages (Sang & Kapur, 2017). Even the absence of a student in the classroom cannot have much effect on learning; because students will be able to adapt to the existing conditions by using textbooks, educational videos, slides, podcasts, and the like (Limueco & Prudente, 2019).

Therefore, the logic of the reverse teaching approach is that this approach increases the engagement of learners with the content, improves the interaction between the teacher and the learner, and strengthens learning (Abushammala, 2019). In this approach, the provision of content in the classroom is abandoned and teachers can provide classroom activities by teaching how learners understand the reasons for the problems and apply the information in real life (Roach, 2014). According to the opinion of many experts (e.g. Abushammala, 2019; Kim et al., 2015), in this way, the content and educational materials are presented before the class time, and during the classroom, they work on advanced issues and concepts and collaborative learning. This model provides the possibility for learners to independently engage in educational materials based on their own time and speed (Fautch, 2015). Since in this approach, the activities supposed to happen at home replace teaching in the classroom, this educational method is called the reverse teaching method (DeLozier & Rhodes, 2017).

In this regard, the studies of Farahmand and Kazemi (2022) have shown that it is necessary to move from traditional education to the design and implementation of new learning methods, including reverse learning. Also, Dasgheib (2022) showed that there is a significant difference between using the reverse learning model and overcoming the fear of mathematics in elementary school, and this educational method can have a positive

effect on the attitude and the anxiety of elementary school students. In another research, Masoumi Fard et al. (2021) and Daivid et al. (2020) also showed that the reverse teaching method increased the self-efficacy and learning of the students. Therefore, it can be said that in integrated flipped learning, metacognitive awareness requires learners to reflect on what they know, care about, and are capable of doing, which not only helps learners expand their self-awareness, but also they offer them some valuable information for education (Abdul Rahman, 2020).

The research conducted on this issue (e.g. Meneely et al., 2002; Piri et al., 2018; You et al., 2008) indicate that when a student has a sense of belonging to the school and class considers him/herself to be a participant and committed to school activities, and this increases the motivation of the student to achieve the desired goals of the school. Participation in school activities has an effect on learning knowledge and motivation of students (Karcher, 2005). The feeling of belonging is the basis of a person's decisions about regulating his/her relationship with the environment or a particular matter. Therefore, the feeling of belonging is the seed of a process during which a person feels a sense of obligation and responsibility towards a place, object, or matter, in a way that causes a positive feeling towards the environment or the issue in question (Nateqhpour, 2009). In this regard, Otrosaborido et al. (2018) showed that learning in a flipped classroom is a reliable tool that facilitates educational process and the sense of belonging to school.

On the other hand, the flipped class does not only include spending classroom time for individual learning, but also includes the use of different types of teaching and learning, encouraging learners to accept responsibility for their own learning, strengthening them to achieve learning to the extent of content mastery (Helgeson, 2015), improves teacher-student interaction (McLean et al., 2016; Rotellar & Cain, 2016) and facilitates deep learning through classroom learning activities (Parshar, 2015). Academic engagement is a psychological investment that strengthens the effort to learn in education and relatively makes students active in academic affairs. In fact, academic engagement makes students take an active role in participation and value interactions with their peers in the classroom. Therefore, reverse learning due to increasing student participation causes more academic engagement in students (Sadeghi et al., 2018). Also, Sahebyar et al. (2021) showed that reverse learning was effective on students' academic engagement and also it affect on all components of academic engagement (cognitive, emotional, behavioral and agency) was positive and significant. Suberamaniam and Mo Niandi (2019) also

concluded that students who were in the flipped class were more active than other students and had more academic engagement.

According to the aforementioned, many of the learning problems in students are due to the fact that they have a passive role in the traditional lecture method, and since today's teaching and learning approaches have changed and students prefer to be in the classroom and learning to have an active role, today there are few students who prefer a passive role in the classroom. On the other hand, learning tools and situations have also undergone transformation and many electronic tools have entered the education process. Hence, the reverse teaching and learning method as an attractive method that involves the student in the teaching process and maximizes the use of educational technologies can probably be a good alternative to traditional education methods and even cooperative education that are used these days to increase student participation. However, due to the newness of this educational method and the lack of knowledge about the way and conditions of presenting this method in schools, it is necessary to identify the indicators and factors needed to implement this educational method in the form of a practical framework as an educational package. Moreover, in order to fill the existing gaps in the implementation of the reverse education method, it should be formulated and its effects on important academic issues such as academic engagement and sense of belonging to the school in students, which can have a direct effect on increasing academic participation and academic progress of students, should be investigated. Therefore, according to the research gap in this field, this research aimed to investigate what the model of reverse learning is in the classroom and how effective the educational program derived from it will be on the academic engagement and belonging to the school of secondary school students.

Method

Design

The current research method was developmental in nature, using sequential exploratory mixed-method design, and adopted meta-synthesis and quasi-experimental intervention. Meta-synthesis is a qualitative method based on a systematic review of library studies for a deep understanding of the studied phenomenon.

Participants

Senior secondary school students of Bukan were selected to implement the educational intervention of

reverse learning. To determine the size of the statistical sample according to the purposeful research method in quasi-experimental studies, 40 male and female secondary school students in two groups of 20 were chosen: the experimental group to experience reverse learning intervention and the control group. The participants were selected according to the inclusion and exclusion criteria, using standardized random sampling. The criteria for the inclusion in the research included the age range of 13-17 years old, studying in the senior secondary school, no history of attending similar interventions and signing a written consent form, and the criteria for excluding the research population included participating in training courses at the same time, suffering from physical diseases and Sporadic participation in training sessions. According to the findings, the average age of the two groups was about 16 years and more than 60% of the sample were male students.

Instruments

The Academic Engagement Questionnaire

The academic engagement questionnaire was designed and compiled by Rio in 2013 to measure academic engagement. This questionnaire has 17 questions and 4 components of behavioral engagement, agent engagement, cognitive engagement, and emotional engagement. Cronbach's alpha coefficient calculated in Ramezani and Khamsan's research (2016) for this questionnaire was estimated to be above 0.7.

The Feeling of Belonging to School Questionnaire

The questionnaire of the sense of belonging to school has 16 questions designed by Brown and Evans in 2002. This questionnaire has 16 items. Brown and Evans (2002) mentioned the reliability coefficient of this scale using Cronbach's alpha method is equal to 0.86. The factorial structure of this scale has been confirmed by applying the factor analysis method. Lucas, Rovalson and Herrera (2010) reported the reliability coefficient of this scale equal to 0.76 and the reliability coefficients of its subscales between 0.76 and 0.77. In addition, Thomson et al. (2006) reported the reliability coefficient of this scale as 0.77 and confirmed its factor analysis.

Intervention

Furthermore, a 10 week training course (two 45-minute sessions per week) was designed and administered by the researcher using the reverse method (based on the package designed and standardized in this research).

Procedure

In the qualitative part, reverse learning indicators were identified via the meta-synthesis method. The research

field for determining indicators included all scientific articles and documents related to reverse learning as a criterion by means of a systematic review of articles from scientific sources such as Google Scholar, Iran Doc, Iran Mag, SID, Normagz, etc. published from 2011 to 2021. In this research, meta-synthesis was employed to identify the effective indicators on the implementation of reverse learning in senior secondary schools. Using the critical assessment skills program or CASP method, each article was evaluated in terms of quality with 10 quality conditions. A score between 1 and 5 was assigned to each of the articles based on each of these conditions. The articles with a total score of 25 and above were confirmed in terms of quality and the rest of the articles were deleted.

In the quantitative part, according to the systematic review of the research background, the educational package was standardized. Also, for the standardization of the designed educational package, the opinions of the professors of educational sciences, educational management, and academic counseling of the Islamic Azad University of Sanandaj were taken into account. Also, 40 male and female students were chosen as the participants of the study in two groups of experimental and control each with 20 members.

Data Analysis

In the present research, the skewness-Kurtosis test was first used to determine the data distribution, and due to the normality of the data distribution, parametric tests were used to examine the research questions. To check the homogeneity of the demographic characteristics in the two research groups, independent t-test was used, and to explain the research hypotheses, the statistical method of multivariate covariance analysis was used.

Findings

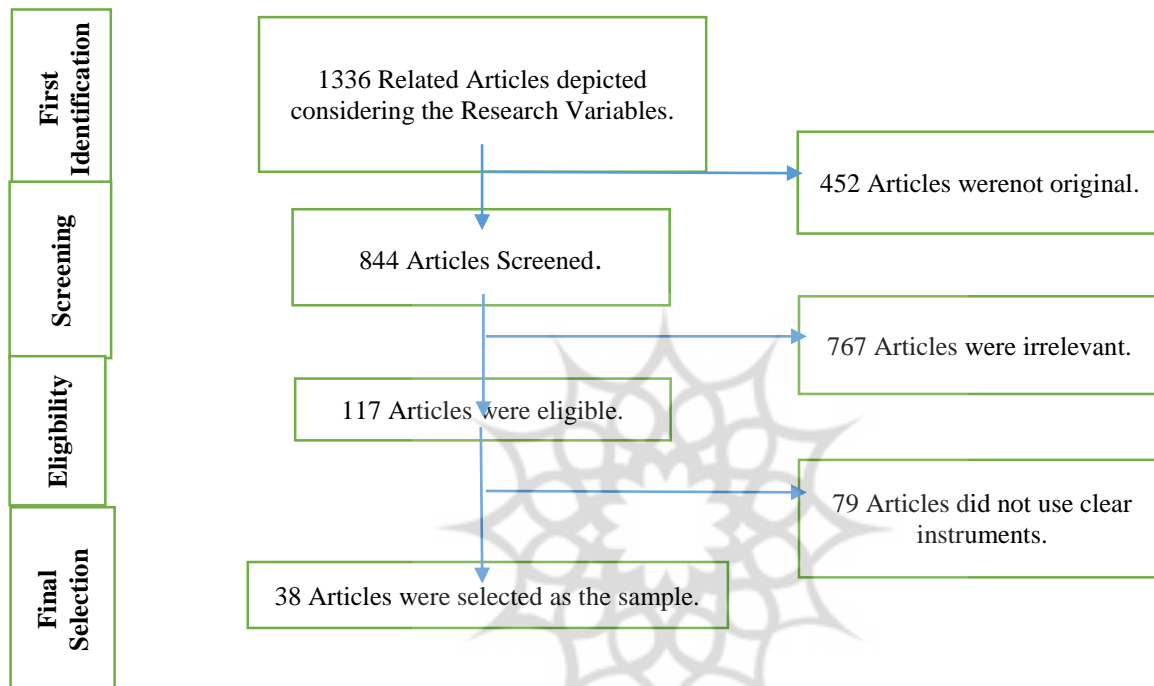
Qualitative Part

In this research, to design a training package for reverse learning, the meta-synthesis method was used to examine all related articles in the period of 2011 to 2021 accessible in the databases of domestic and foreign scientific articles to see what factors and components are effective in the implementation and training based on reverse learning. To this end, the keywords 'reverse learning', 'reverse learning teaching', 'reverse learning process', were used for the search in the databases. In the next step, various parts of the articles such as 'title', 'abstract' and 'content' were evaluated to select suitable articles based on the observed algorithm. In the title section, related articles were selected. In the content section, content analysis was done based on the studies addressing the factors related to reverse learning and

irrelevant sources were removed. In each review, a number of articles have been excluded from the meta-analysis process. To check the meta-synthesis validity of all the selected articles, the 10 CASP criteria were observed based on which 38 studies had a value higher than 31. Also, coding and classification of information was also used to check the data. All these activities were

done to ensure the quality of this research findings. Based on the criteria, 23 articles were selected. The lowest average score given to the articles was 31 and the highest was 48, and therefore, it can be claimed that the selected articles for data analysis in this research were at an acceptable level. Figure 1 shows the steps taken to select the articles.

Figure 1
Summary of the Article Selection Process



In the next step, the information of the articles were classified based on the information of each article, including the author's name, the year of publication and the components expressed in each article, and the

desired factors extracted from the articles were considered as codes. The results of this process are shown in Table 1.

Table 1
Codes and Information Resources

No.	Code	Source	No.	Code	Source
1	Activities before and during class	Song and Kapur (2017); Fazi & Hossein (2016)	11	Efforts to improve efficiency	González Gomes et al. (2016), Jangen & Gui Fung (2015)
2	Activities before the class	Merauk et al. (2010)	12	Activities at home	Mosalanejad & Abdullahi Fard (2017); Kheirabadi (2016)
3	Basic training other than the class time	Pinoz Velez et al. (2020); Hamadan et al. (2013)	13	Self-evaluation and self-efficacy	Moffet (2015); Tofaninejad et al. (2018); Amazindost & Kak Mack (2020); Lee Su Ping et al. (2020)
4	Activities during the class	Schwarzenberg et al. (2018)	14	Competition between students	Dahaghin & Hijazi (2018)
5	Content preparation	Zeinaldin & Halili (2016); O'Flaherty & Phillips (2015)	15	Participation and exploration	Sadeghi & Mahmoudi (2018); Suberamianam & Mo Niandi (2019)

No.	Code	Source	No.	Code	Source
6	Preparing the environment	Niro & Aslani (2019); Mobsermaleki & Kiyan (2018)	16	Personal support	Ehteshami et al. (2018)
7	Activities in the peer group	Yong et al. (2015)	17	Metacognitive awareness	Abdul Rahman (2020)
8	Providing learning content to the learner through video or podcast	Abbasi et al. (2017); Kaviani et al. (2016); Bagheri & Joshaghannejad (2015); Attaran (2015)	18	Self-management and self-leadership	Myung & Bu (2018); Ishikawa et al. (2015); Mcneely et al. (2016)
9	Checking the assignments	Kaviani et al. (2017); Sanago et al. (2015)	19	Accepting the responsibility for their own learning	Helgeson (2015); Fautch (2015); Osot (2014)
10	Learners' presentations and projects, diversity in content	Alavi Moghadam & Bahmani (2018); Kaviani et al. (2016), Schmidt & Ralph (2016)	20	Student-centered classes	Huelscamp (2015); Bergmann (2014)

According to the information in Table 1, 25 primary codes were extracted from among the studies reviewed. It should be noted that some of these codes have shared meanings and overlapped; therefore, in the next step, the extracted codes were analyzed and combined. Finally, all the factors extracted from the previous studies were coded and then by considering the 'concept' of each of

these codes, they were categorized under a similar concept, and the concepts of this research were determined in this manner. Based on the analysis, a total of 4 categories, 8 concepts, and 23 codes for reverse learning were discovered and labeled via the content analysis of the 54 final selected articles. Table 2 shows the final extracted codes.

Table 2
Categorization of Findings

Subject	Concept	Code
Self-Preparation	Students' Self-Control	Efforts to improve efficiency Self-evaluation Self-efficacy Self-management Self-leadership Accepting the responsibility of own learning
	Self-Learning Skill	Cooperation Exploration Personal support Metacognitive awareness
Educational Preparation	Before and During Class Activities	Before and during class activities Before class activities Student-centered class During class activities
	Extra-Class Activities	Homework activities Basic training out of class time
Environmental Preparation	Educational Environment	Environment preparation
	Competitive Environment	Activities in peer group Competition between students
Content Preparation	Content-based Learning	Learning content presentation to the learners Diversity in content
	Technology-based Learning	Presentation via videos or podcasts Learners' presentations and projects

In this study, considering the characteristics of the learners and educational goals (the eight concepts), the experimental group experienced the researcher's model

based on the combined results of related studies to achieve the goals of the research. That is, based on this model, according to the educational goals, the training

sessions were implemented using a different method. Each session designed considering the detailed objectives of that session and for better understanding of the subject, resources such as pamphlets, films and booklets were used according to the subject, and at the end of each class, the students were evaluated and if the learners achieved the mastery in the subject and the

educational goals, the next subject were introduced (if an educational goal of that session was not achieved, the educational method was revised to achieve the desired skill for the learners). In fact, one of the characteristics of this model is the inclusion of two evaluation activities and revision of other components.

Table 3

Summary of the Reverse Learning Training Package

Week	Reverse Learning	Description
1	Introduction, Grouping and Basic Training	Students are divided into homogeneous groups and explanations are given about how to work, and then the lessons are introduced at the beginning of the semester and the reverse learning method will be explained.
2	Students' Self-Control	In this session, students will be taught things such as efforts to improve efficiency, self-evaluation, self-efficacy, self-control, self-leadership, and acceptance of responsibility for their own learning.
3	Self-Learning Skills	In this session, students will learn about things like participation, exploration, personal support and metacognitive awareness and how to use them.
4	Activities During And Before Class	In this session, issues related to activities before and during class, activity before class, student-centered class, and during-class activity will be taught along with the benefits and the right way of student-centered learning.
5	Extracurricular Activities	In the fifth session, activities at home and basic education outside of class time are emphasized and students' minds are prepared in this regard.
6	Educational Environment	In this session, the preparation of the environment and required technologies and the type of relationships will be explained and described.
7	Competitive Environment	In this session, the issue of understanding, communication and positive interaction with peer group activities and competition between students is focused.
8	Content-Oriented Learning	In this session, the provision of inclusive learning content and diversity in content and how to access, use and exploit the content will be taught.
9	Technology-Oriented Learning	In this session, the concepts, applications and how to access the presentation content through video or podcast and the learners' presentations and projects are taught.
10	Winding Up	In the last session, all the concepts are reviewed and by presenting a challenge and a group discussion, reverse education is reviewed experimentally in the class.

In order to check content validity, the training package was reviewed by 2 experts in this field. In order to determine the general validity and the level of agreement between experts in the meta-synthesis

method, first the results along with general and specific objectives were presented to 10 experts in order to apply the opinion based on the Lawshe (1975) model in the following cases.

Table 4*The Results of the Kendall Coefficient of Validity of the Educational Package*

Component	CVR		CVI					Relevance			Clarity				
	Necessity		Simplicity			Relevance			Clarity						
	Necessary	Useful	Unnecessary	Very Simple	Simple	Quite Simple	Not Simple	Completely Relevant	Relevant	Quite Relevant	Irrelevant	Very Clear	Clear	Quite Clear	Not Clear
Designing the Package	8	2	1	9	0	1	0	8	1	1	0	7	2	1	0
Adaptation of Content to the Objectives	9	1	0	10	0	0	0	8	1	1	0	8	1	0	1
Proper Arrangement of Sessions	10	0	0	8	0	1	1	7	1	1	1	8	2	0	0
Compliance with Theories	8	1	1	8	1	1	0	6	3	1	0	7	2	1	0
General Texts of The Package	8	1	1	7	2	1	0	8	2	0	0	8	1	1	0
Coefficient of Agreement	0.929		0.772			0.898			0.860						

After collecting the opinions of the experts, useful suggestions and comments were included in the questionnaire. The face and content validity of the questionnaire was confirmed by 10 academic counseling and educational planning professors, and the results of Kendall's correlation coefficients was found to be above 0.7 confirming the validity of the form and content of the questionnaire. Reliability was also checked using Scott's Pi coefficient method. Scott's pi criterion was designed by William Scott in 1955 to measure the reliability of

nominal data. In this method, two coders (evaluators) must provide the data, and reliability was determined based on the correlation of the data of these two evaluators.

$$Pi = (OA - EA) / (1 - EA)$$

$$Pi = (0.864 - 0.50) / (1 - 0.50) = 0.728$$

Considering that the Scott's pi coefficient is higher than 0.07, the reliability of the evaluation method is confirmed.

Table 5*Comparison Of Age Between the Experimental and the Control Groups*

Variable	Control Group	Experimental Group	Independent T-Test Result
	Mean± SD	Mean± SD	
Age	15.7±1.21	16.00±1.02	t= -842/0 df=38 P=0.405

The results of the above table show that the average age of the two groups was about 16 years old, and there is no statistically significant difference between the control and experimental groups in terms of age

($p > 0.05$). In order to determine the normality or non-normality of the distribution of the statistical sample, the skewness and kurtosis tests were performed.

Table 6*Determining the Normality of the Data*

	Mean	SD	Skewness		Kurtosis	
			Statistic	Error	Statistic	Error
Sense of Belonging to School	55.45	7.83	1.276	0.374	1.196	0.733
Academic Engagement	61.85	6.84	-0.452	0.374	0.033	0.733

The value of observed skewness for the studied variables is in the range of 2 and -2. It means that in terms of the skewness, the variables are normal and their distribution

is symmetrical. The kurtosis value of the variables is also in the range of 2/-2 displaying that the distribution of the variables is normal. In this research, before analyzing the

data, M-box test was used to check the homogeneity of the variance of the variables (Table 7).

Table 7

M-box Test Results for Homogeneity of Variances

	M-Box	F	Df1	Df2	P
Academic Engagement	57.118	8.730	6	10942	0.128

According to the Table, the M-box test value is not significant for the research variables. Therefore, the variance of the two experimental and control groups in the research variables are not significantly different and the assumption of homogeneity of variances was confirmed. The results of the regression slope

homogeneity test showed that the interaction of pre-test and post-test variables at the factor levels is not significant. Therefore, the assumption of regression homogeneity is observed in all variables.

Table 8

Results of Significance Test of Multivariate Covariance Analysis (MANCOVA)

Test	Value	F	Num DF	Den DF	P	Effect size
Pillai's Trace	0.866	72.97	3	34	0.001	0.866
Wilks' Lambda	0.134	72.97	3	34	0.001	0.866
Hotelling-Lawley Trace	6.439	72.97	3	34	0.001	0.866
Roy's Greatest Root	6.439	72.97	3	34	0.001	0.866

According to Table 8, the F ratio obtained regarding the effectiveness of the reverse learning intervention on the academic engagement of the students of the experimental group is significant indicating that reverse learning has affected the academic engagement of students. In addition, the effect size obtained in this

study was equal to 0.866, which indicates that 86% of the difference in the post-test scores of the variables of the academic engagement indicators of the experimental group is related to the effectiveness of reverse learning training.

Table 9

The Results of the Covariance Test on the Effect of Reverse Learning on Academic Engagement

Variable	value	SS	DF	MS	F	P-value	Effect Size
Academic Engagement	Source	210.039	1	210.039	3.107	0.006	0.176
	Error	2568.72	38	67.59			
Behavioral engagement	Source	16.757	1	16.757	2.020	0.013	0.15
	Error	315.25	38	8.296			
Agent engagement	Source	0.641	1	0.641	2.122	0.008	0.030
	Error	198.88	38	5.238			
Cognitive engagement	Source	43.867	1	43.867	14.828	0.001	0.281
	Error	112.422	38	2.958			
Emotional engagement	Source	20.944	1	20.944	2.122	0.009	0.151
	Error	393.97	38	10.368			

The results of Table shows that, considering the significance level of $p=0.001$ which is less than 0.05, it can be claimed that with a confidence level of 99%, reverse learning has a significant effect on the academic engagement of students. Also, the eta coefficient shows that reverse learning explains 0.176 of academic conflict

changes, 0.15 of behavioral conflict changes, 0.03 of agentic conflict changes, 0.281 of cognitive conflict changes and 0.151 of emotional conflict changes in the students.

Table 10*Results of Levene's Test For Homogeneity of Variance*

Sense of Belonging to School	F	Df1	Df2	P
	2.030	1	38	0.162

As to the Table, Levene's test is not significant in the research variables. Therefore, the variance of the two experimental and control groups in the research variables are not significantly different and the

Table 11*The Results of the Covariance Test on the Effect of Reverse Learning on the Sense of Belonging to School*

Variable		SS	DF	MS	F	P-value	Effect Size
Sense of Belonging to School	source	1037.944	1	1037.944	139.285	0.001	0.790
	Error	275.722	37	7.452			

The results of Table 11 demonstrates that, according to the significance of $p=0.001$ which is less than 0.05, with a confidence level of 99%, reverse learning training has a significant effect on students' sense of belonging to school. Also, the eta coefficient shows that reverse learning training explains 0.790 percent of the changes in students' sense of belonging to school.

Discussion

Today, teachers have a key role in teaching as facilitators and not just knowledge transmitters as before, and this change requires a modification in education and the role of students as a teacher in the class. The participation of both the students and the teachers in the teaching and learning process cannot be achieved unless students' attitudes and teacher's expectations towards the teaching process change. Reverse teaching/learning method and its influential indicators can improve the teaching process and students' educational experience. For this reason, this research designed a reverse learning model and investigated the effectiveness of the educational program derived from it on the academic engagement and sense of belonging to the school of senior high school students of Bukan. In total, 4 categories, 8 concepts and 23 codes for reverse learning were discovered, labeled and confirmed in this research, and based on these information sources, a training package was designed in 10 sessions whose reliability and validity were confirmed via Scott's pi and Lawshe tests. The results of the analyses showed that the reverse intervention had a significant and positive effect on the participants' academic engagement and school sense of belonging.

According to the findings, the experimental group exposed to reverse learning method had a significantly ($\text{sig}<0.05$) higher mean in all four components

assumption of homogeneity of variances was confirmed. Also, the pretest results of the regression slope of the second hypothesis showed that the group interaction in the pre-test is significant, and considering that the group \times pre-test interaction is significant; therefore, the data does not support the assumption of homogeneity of the regression slope.

(cognitive, emotional, behavioral and agent engagement) than the control group. Therefore, based on the findings of the research, the students who were taught in the classroom in the reverse method, were involved and actively participated in the activities related to problem solving, assignments and tasks of the math course. The results of the studies also showed that the students' perceptions of reverse teaching-learning activities were positive, and they preferred to have classes in the form of video and clips, interactive activities and class engagement. These findings are in line with those of Sahibyar et al. (1400), Samavi et al. (2020), and Subramaniam and Muniandy (2019).

On the other hand, the findings of the research displayed that reverse learning has a positive and significant effect on students' sense of belonging to school ($\text{sig}<0.05$). Therefore, in the reverse class model, the participation of learners is relatively more responsible and more interactive. It seems that in this approach, learners are more involved in lesson concepts and this factor increases the quality of comprehensive learning and makes students feel more compatible. Also, the participation of learners improves the quality of education and optimal use of classroom time by using different educational strategies. The majority of learners prepare their homework before the class and they will feel more comfortable and finally it will reduce students' anxiety. Also, improving interactions with classmates and teachers and more participation in extracurricular activities and school affairs are other consequences of implementing the reverse classroom approach in relation to students' sense of belonging to the class and school. In this regard, Izadi et al. (2019) showed that the use of the reverse classroom approach compared to the traditional approach had a positive effect on the sense of belonging to the school.

Conclusion

Even though we are living in the crossroads of science production in the current century and we are witnessing changes in all aspects of life, the teaching methods in various educational institutions are still the old methods of the 20th century. For this reason, considering the many advantages of the flipped or reverse teaching method, it can be regarded as one of the most effective teaching methods. Moreover, due to the large number of students in classes and the limitation of teaching hours, the use of the reverse teaching method can lead to deeper and wider learning of the lesson concepts. Reverse learning strengthens students' classroom activities, their sense of self-efficacy, their motivation and enthusiasm for studying and the sense of belonging to school and decreases school truancy. Therefore, based on the results of this research, the reverse learning model can be designed to improve and modify the country's curriculum in order to provide appropriate methods for virtual education. This approach will increase the use of educational technologies and the effectiveness of education in the new era.

Positive and sustainable educational results in using reverse approach can be observed in children when, before any type of education, teachers and managers introduce the program and its theoretical foundations to students in workshops and support them while using the components of the educational package. Therefore, it is suggested that the educational managers hold classes and workshops for teachers to familiarize them with this method and provide a guide as educational templates for the teachers. Moreover, the age of the students, the need to foster students' participation in the classroom, the active communication within the classroom, and pre-analysis of the variables as an operational issue should be considered in advance as not paying attention to these matters will decrease the overall speed of the classroom and have a negative effect on the students behaviors. Therefore, it is suggested not to use the flipped class approach for all courses and all sessions, and prioritize flexible and attractive items according to the subjects. Considering that academic engagement and belonging to school are recent research concerns in the field of positive educational psychology, and that in contemporary educational methods, learners' responsibility and increasing learner agency are within the framework of constructivist goals, holding training courses based on reverse learning method and familiarizing all those involved in education with the goals of positive educational psychology can be a fundamental step towards academic well-being and expand academic satisfaction.

This research faced with some limitations. The sample of the study was limited and thus, the results should be generalized with caution. Also, this research focused on the students' engagement and sense of belonging to school. Future studies can focus on the impact of some other variables such as social, cultural, psychological, biological, family atmosphere and interest in education, etc., as well as other educational levels. Finally, considering the the multifacetedness of learning and teaching, this approach can be used along with other approaches in other studies. Also, it is suggested that in future studies, the effectiveness of the reverse learning method on the variables preventing academic health, such as self-incapacitation, procrastination, and academic burnout, may be considered in order to take a step towards a more accurate understanding of the teaching methods that facilitate the academic health-oriented lifestyle and guide future research. Moreover, Future research can focus on the effectiveness of the reverse intervention considering such variables as gender and educational level.

Conflicts of Interest

No conflicts of interest declared.

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