

# The Effect of Van Hiele Theory-Based Teaching Educational Package on Achievement Goal Orientation of Student Teachers

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## Abstract

The purpose of this study is to examine the effect of Van Hiele theory-based teaching educational package on achievement goal orientation among student teachers. Research method of this study was quasi-experimental with plan of pretest-posttest and control group. Statistical population includes all student teachers Farhangian University of Isfahan, Iran so that two groups of participants with 176 members were randomly assigned to experimental and control groups responded the standardized questionnaire of achievement goals including four types of orientations mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance. To analyze the obtained data from questionnaire, descriptive statistics and Analysis of Variance (ANOVA) was used. According to the obtained result, the mean difference between pretest and posttest scores of experimental group was significantly more than control group in terms of orientation of mastery-approach (mastery-oriented). This difference was not significant for other variables in two experimental and control groups. People with mastery-oriented goals try to increase their abilities emphasizing on perception, vision and skill. Hence, educational package is suggested to develop and improve competences through increasing the level of understanding and perception of matter in order to professional promotion of teachers.

**Keywords:** teaching educational package, Van Hiele theory, achievement goal orientation, student teachers

## 1. Introduction

Curriculum theorists believe that teaching methods can be used to achieve goals of education system so that these goals that are directly and indirectly affected by these methods (Najafipour & Jafari, 2013; Brophy, 2013). Application of active teaching methods would lead to strengthening self-confidence among students, development of mental and practical skills in students, domination of self-regulation environment on class, attention toward personal differences and preparation of field for creativity and innovation (Bassot et al., 2013; McLaughlin, 2014). Educational completions are replaced with teamwork and collaboration in this approach (Miller & Peterson, 2003; Fahmy & Lagowski, 2011; Rosenbaum, 2012; Vishnumolakala, 2013). Therefore, it seems that one of the important and essential actions within education and training issue is to equip teachers with appropriate and active teaching-learning methods with the aim of increasing interaction and friendship among students as well as “learning how to learn” (Oakley et al., 2004). One of the active methods is Van Hiele theory-based teaching presented by two Dutch educators Dina Van Hiele Geldof and Pierre Van Hiele (1959). Van Hiele theory is a learning model that presents different types thoughts experienced by learners when face geometric shapes so that this model comprises from visual dealing with geometric shape to formal understanding of geometric proof (Liaghatdar et al., 2011). According to this theory, students would move through the path from just recognizing to write a formal exact geometric proof. This theoretical model explains that why student face problems when learning geometry in general and when writing a proof in particular. This model includes two parts of thinking levels and phases of instructions so that many of researchers have studied in this field; some of these researchers are Alex and Mammen (2016), OFLAZ et al. (2016), Sinclair and Bruce (2016), McBroom et al. (2016), Zilková et al. (2015), Mudaly (2015), Dindyal (2015), Tsamir et al. (2015), Thomas (2015), Kaur (2015), Zagorianakos and Shvarts (2015), Luneta (2014, 2015), Sinclair and Catherine (2015), Weiss and Herbst (2015), Patkin and Ruthi (2014), Couto and Isabel (2014), Ľilková (2014), Abdullah and Zakaria (2012, 2013), Clements and Sarama (2011), Breyfogle and Lynch (2010), Mason (2002, 2009), Idris

(2007), Oreyzi (2000), Gholam Azad (2000), Reihani (2005), Sadr Arhami (2006), Moradi (2007), Moradi Veys (2009), and Tajik Khah (2012).

The importance of learning action between students and teacher is emphasized within phases of instruction of Van Hiele model. It would be impossible to pass from a level to another level without transmission operation. For this purpose, students should be trained through an organized and purposeful method (Oreyzi, 2000). Phases of instructions are belonged to teachers who organized geometry teaching method to facilitate and help growth of students to transmit from the current thinking level to next thinking level. These phases are as follows:

- Information: at this step, teacher and students are discussing and doing activities in terms of studied matters and students become familiar with work field.
- Directed Orientation: students would develop and learn every studied topic through activities designed by teachers. These activities includes folding, measuring, and search for diagonal, symmetry and so on.
- Explication: students are aware of some networks of relationships trying to express them with their special linguistic vocabularies.
- Free Orientation (unlimited): students are made doing some activities and problem-solving tasks enabling them do those tasks and activities through different methods, knowledge, skills, and learnt relationships.
- Integration: students are able to see the knowledge, information, and new relationships in frame of a new and integrated whole.

Since some studies including Meece et al. (2006), Greene et al. (2004), Jury et al. (2015), McLaughlin (2014), Fink (2013), Vishnumolakala (2013), Bassot et al. (2013), Brophy (2013), Rosenbaum (2012), Fahmy and Lagowski (2011) have reported a positive relationship between academic achievement and motivational factors and some others researchers including Berger and Shaughnessy (1986), Crowley (1987), Fuys, Geddes and Tishler (1988), Guterrez (1991), Halt (2007) quoted by Liaghatdar et al. (2012), Farin (2014), Alex and Mammen (2016) have reported dissatisfaction with geometry curriculum, lack of interest in geometry lesson among learners and lack of tendency of some teachers to teach geometry, this will be a question that who are required to achieve success in field of attempts for improvement of education and training and which one of motivation theories within theoretical territory of motivation is more powerful to make learners being involved in achievement and effort?

According to Skinner (2016) and Engel (2015), professional development and increasing knowledge and skill of teaches are essential in order to gain success in field of conducted efforts to improve education and training. Hence, the past decade the focus of negotiation about improvement and increase of education and training quality had been on Teacher Professional Development (Richter et al., 2011). The new findings in scope of educational-psychological studies have emphasized on paying attention to relevant variables to students and improvement of quality of their education and learning as well as teachers' skills for more efficiency in their profession (Patrick, Anderman, Bruning, & Duffine, 2011). On the other hand, the collection of methodical efforts of interested researchers in theoretical field of academic achievement motivation indicate that theory of achievement goal orientation have been able to explain the reason for emergence of multiple behavioral patterns in achievement environments such as Failure avoidance, Learned helplessness, Effort avoidance, Self-Handicapping, Perfectionism, Procrastination, and Passive Aggression in range of contemporary conceptual formulation about the serious subject of academic achievement motivation among learners (Seifert, 2004; Martin et al., 2001; Butler, 2014; Schwinger & Pelster, 2011; Elliot, 2005, 2006; Soini, Salmela Aro, & Niemivirta, 2012; Huang, 2011; Jang & Lio, 2011; Chen, 2015; Jury et al., 2015; Lavasani, Hejazi, & KhezriAzar, 2012; Zare & Rastgar, 2014; Davari, Lavasani, & Ejee, 2012). Achievement goal orientation theory is one of the newest approaches has entered into the scope of motivation psychology during three current decades. This theory is the result of attempts of psychologists who work in scopes of motivation, growth, social psychology and educational psychology. In fact, goal orientation indicates a coherent pattern of person's beliefs guiding the person tend to situations based on different methods working in such field and finally presenting a respond (Ames, 1992). The conceptual base of all theories and models about achievement goal approach has concentrated on the intention of relevant activities and behaviors to achievement (Elliot & McGregor, 2001). This approach discusses the inclusive perception from the reason for effort within achievement situations instead of considering the goal of learner in achievement situation (Braten & Stromso, 2001).

Elliot (2006) considers goal orientation a method that person judge about his or her competence based on it. Accordingly, Elliot and McGregor (2001) introduce a new perspective in field of goal orientation known as 2×2 model. They believe that the main concept of goal orientation is "competence". The framework of goal

orientation in this theory is differentiated on two fundamental dimensions—according to who it is defined and according to how it is valenced. Competence is defined either based on absolute criteria or based on normative criteria. According to the definition of competence based on absolute criteria, the person is to understand or master a task or acquire knowledge for development of personal skills but people who define competence based on normative standards, will feel competent if have better performance than others. Therefore, competence is divided to two components of mastery-oriented and performance within definition dimension.

The other dimension of competence in this theory is valence. This dimension would examine the goal direction that can lead to achievement or failure avoidance. The behavior of person is orientation-based and the aim is probable acquisition. This model introduces four types of goal orientation including mastery-approach goals, mastery-avoidance, performance-approach, and performance-avoidance through combining two dimensions of definition and valence in competence (Johnson & Kestler, 2013; Dinger et al., 2013). Position of these goals has been depicted in Table 1.

Table 1. The 2×2 achievement goal framework (Elliot & McGregor, 2001)

		Definition	
		Absolute/intrapersonal (mastery)	Normative(performance)
Valence	Positive (approaching Success)	Mastery-Approach goal	Performance-Approach goal
	Negative (avoiding failure)	Mastery-Avoidance goal	Performance-Avoidance goal

Table 1 represent definition and valence of two dimensions of competence. Absolute/intrapersonal and normative criteria are two ways that competence can be defined based on them and positive and negative are two methods that competence can be valenced based on them.

According to goal orientation of mastery-approach, the person emphasizes on some goals such as possible learning, overcoming challenges, and increasing competence level and the topic base in mastery-approach is development and improvement of competences through increasing understanding and perception level so that these people are interested to be involved in challenging tasks and complete understanding the tasks considering the failure as the introduction of a high level perception in terms of competences' development (Elliot & Trash, 2002; Kaplan, Martin, & Maher, 2007; Fink, 2013).

In mastery-avoidance goals, person hardly strives to avoid misunderstanding or failing in learning. They are scared of not to understand subjects, failure in learning of course materials or forget the learned topics. Competence is defined as the complete mastery on tasks in this orientation and all efforts are done to avoid making error (Elliot, 2006; Pintrich, 2000).

People who have performance-approach orientation want to show their abilities to others. It is emphasized on confirmation of performance and acquiring desired judgment of others about personal performance in this orientation and this orientation is based on acquiring positive judgment of others as well as attention toward social comparisons (being better than others) (Pastor, 2007; Kaplan & Maehr, 2007).

People with avoidance-performance goals are motivated to avoid looking incompetent or “stupid” striving to avoid of failure. In this orientation, competence means avoiding of failure and the focus is on social comparison but it is emphasized on avoidance of humility and looking slow learner (Pintrich & Shunk, 2002; Kaplan & Maehr, 2007).

According to the role of teachers in educational systems, implementation of programs is an undeniable necessity to increase motivation, achievement and attempt of teachers making them search for challenging tasks. According to researches about motivational processes of teachers, good teachers are recognized as self-motivated learners and such motivation in professional activities is directly related to their job satisfaction (Fernet, Guay, Senecal, & Austin, 2012). Hence, the researcher findings indicate that success in education not only require a coherent knowledge but also needs benefitting from an appropriate and adaptive motivational model so that the orientation of the goal and role of this factor in academic activity is highly important (Pajares & Schunk, 2001; Pintrich, 2000; Covington, 2000; Tuominen-Soini et al., 2011; Cobb, 2011).

It can be eventuated that majority of researches about achievement goals have been correlational and there has been few conducted studies to examine effectiveness of psychological interventions on mastery goals increase.

Hence, in accordance with existing research gap in field of experimental education of achievement goals and importance of it the present researchers aimed to promote effectiveness of this education among teachers using Van Hiele and appropriate principles of educational design (Fardanesh, 2008; Lee, 2006; Karagiorgi & Symeou, 2005) in frame of educational package. Educational package should comprise the required attraction and diversity in order to provoke internal motivations for deep, extensive and sustainable learning (Majdfar, 2014) stimulating learners to increased mastery and enjoyment of geometry not just gaining score. Therefore, the general goal of this study is to examine the effectiveness of prepared education package on achievement goals of students teachers based on Van Hiele theory.

## 2. Research Method

Method of this study is applied in terms of objective using quasi-experimental method with control group and pretest-posttest. The summary of research plan is presented in following table. Statistical population of study includes all student teachers of Farhangian University. The sample included free volunteer teachers because volunteer sample is the best sample within researches that requires high effort of participants (Gall et al., 1996). Participants of research were student teachers that randomly assigned into experimental and control groups. These students were equal to 176 members that 105 members were distributed in three classes as experimental groups, educational package were taught, 71 members were assigned to two classes as control group, and traditional method of education was taught to them.

## 3. Data Collection Instruments

Achievement Goal Questionnaire (AGQ) was used in this study to measure research variables. Elliot, Mc Gregor (2001) designed the 12-items questionnaire of achievement goals orientation. Validation of this questionnaire has been confirmed by some researchers such as Awofala et al. (2013); Shokri et al. (2009), Khorrani et al. (2007). For instance, Hosseinian and Latifian (2009) used factor analysis method with method of principle components and Varimax rotation to examine validity of this scale and the value of coefficient of sample adequacy indicator (KMO) was calculated to 0/76 and Chi-Square of Bartlett's test of sphericity was obtained to 480/02 that was significant at level of 0/0001 indicating adequate sample and selected variables for factor analysis. To examine reliability of this questionnaire, internal consistency method was used. The Cronbach's alpha coefficient of questionnaire was obtained to 0/817 and equal to interval of 0/605-0/804 for subscales indicating reliability of instrument. To analyze obtained data from questionnaire, descriptive and Analysis of Variance (ANOVA) was applied.

Table 2. Psychometric properties of research instruments in present study

Instrument	Number of questions	Cronbach's alpha
Performance-approach goal	3	0/605
Performance-avoidance goal	3	0/781
Mastery-avoidance goal	3	0/804
Mastery-approach goal	3	0/775
Whole of questionnaire	12	0/817

## 4. Research Executive Steps

Researchers of this study aimed to represent a multi-channel relationship in education in which, emphasis was on the role of teacher, student and educational materials in teaching; hence, they prepared and validated the theoretical framework of package based on "Van Hiele Theory" using aligning method including gathered theoretical bases and relevant conducted studies to the research variable benefitting from opinions of key experts and then taught the educational package 15 during an hour and a half sessions through changing the teaching method from traditional to active (teaching educational package) using designed pretests and posttests. The framework of educational package is existed in detail at drmahdian.ir website. Some of dimensions of package were designed in field of achievement goals. These dimensions are as follows:

**1) Task plan:** task plan was related to design of learning tasks and activities. According to Ames (1992), some properties of class assignments can encourage students to choose mastery-approach goal. These properties include: A) diversity and variety of tasks can be effective in interest of students helping students choose mastery goal orientation through decreasing comparison level in class and reducing comparing opportunities of

performance, B) The second property of these tasks is who they are introduced and presented to student. If teachers can help students see how tasks are related their life and content of tasks is beneficial for their learning, it will be facilitate to tend toward mastery-approach goal, C) On the other hand, Schunk and Zimmerman (1994) have expressed those tasks with structures that follow specific and short-term goals can help students to adjust their efforts in order to access them or feel efficacy through accessing to these goals.

**2) Authority:** this dimension included given opportunity to students choosing tasks. Relevant researches to goal theory and internal motivation theory indicate that having control and right to choose among students would increase their interest in task and cognitive activity within task doing (Ames, 1992a).

**3) Recognition:** recognition was use of formal and informal reward, incentive, and admiration with a considerable effect on motivation of students for learning. According to Ames (1992b), it is suggested that university professors and teachers of education and training system recognize effort, improvement and accomplishments of students to create mastery-approach goal based on this dimension. In this case, any use of reward or incentive is based on the learning and advancement of the person not based on normative comparisons.

**4) Grouping:** grouping dimension mentioned the ability of students to collaborate with each other because some opportunities should be prepared to form heterogeneous cooperation groups and peer interacts. Working in small groups is beneficial especially for students with fewer successes to cooperate within group and feel efficacy because of good performance of group.

**5) Evaluation:** evaluation included some methods to monitor learning and assess learning process among learners. According to this dimension, Ames (1992b) assumes that the transferred feedback of this concept to learner is that error is a part of learning and effort is important point so that this would help learners choosing mastery-approach goal. Moreover, Ames states that whenever evaluation criteria prepare the field to evaluate individual progress and situation instead of normative comparisons then students would more pay attention to learning and mastery over topics. Teachers should take precaution when using normative scoring systems in which learners are compared to each other because such normative comparisons can reduce efficacy feeling in learners who had not have a good performance compared to their peers.

**6) Time:** time included appropriate rate of teaching and allocated time to assignments. According to Epstein (1989), some authorities and rights to choose should be given to learners within task planning instead of determining timing opportunities only by teacher. Giving authority and choice opportunity would help mastery-approach orientation.

## 5. Findings

Table 3 represents mean, standard deviation of scores of each group before the start and after the end of classes.

Table 3. Mean and standard deviation of dimensions of achievement goals before the start and after the end of classes based on group

		Control		Experimental	
		Mean	Standard deviation	Mean	Standard deviation
Performance-approach	Pretest	3/74	0/53	3/65	0/46
	Posttest	3/82	0/95	3/65	0/75
Performance-avoidance	Pretest	3/61	0/48	3/50	0/48
	Posttest	3/69	0/32	3/65	0/35
Mastery-avoidance	Pretest	3/55	0/41	3/51	0/36
	Posttest	3/63	0/41	3/69	0/36
Mastery-approach	Pretest	3/84	0/37	3/96	0/52
	Posttest	3/78	0/38	4/20	0/33

According to the obtained results, the mean of all dimensions of achievement in treatment group except performance-approach goal has been increased after participating in classes. To examine the hypothesis about the effect of educational classes on different dimensions of achievement goals, the difference between pretest

and posttest scores was calculated and multi-variable analysis of variance (MANOVA) was used for hypothesis testing. Wilks' lambda is one of the values used for MANOVA that is a parametric test based on two initial assumptions. Homogeneity of covariance matrix of random variables in different groups known as assumption of sphericity and normality of continuous distribution of random variables within different groups are two assumptions that their accuracy should be examined before implementation of test. If the sample size is enough large, MANOVA test has no considerable sensitivity to deviation from normality of continuous distribution of random variables but sphericity assumption should be tested. Table 3 indicates test of sphericity assumption using M Box Test of Equality of Covariance Matrices (Anderson, 2006). According to the obtained result of this test, sphericity assumption or Equality of Covariance Matrices of random variables in two groups is rejected at level of 0/05.

Table 4. Sphericity assumption test

	<b>M Box value</b>	<b>F</b>	<b>First df</b>	<b>Second df</b>	<b>Prob</b>
<b>Value</b>	22/924	2/169	10	11075	0/017

Since the first hypothesis of Equality of Covariance Matrices of random variables has been rejected in this study, the Wilks' lambda test cannot be used to examine the assumption of equality of mean of achievement goals' dimensions. However, some other values of tests exist that are more resistant against deviations from initial hypotheses of model. Pillai is a value test has indicated that is more resistant against deviations from assumptions of MANCOVA test compared to other tests (Olson, 1974).

Table 4 indicates the result of equality test of mean vector of different dimensions of achievement goals within two groups using four tests. As it is observed, the assumption of equality of mean vector of achievement goals' dimensions within two control and experimental groups using four tests such as Pillai test has been rejected at level of 0/05.

Table 5. Testing assumption of equality of mean vector of achievement goals' dimensions in two control and experimental groups

	<b>Value</b>	<b>F</b>	<b>First df</b>	<b>Second df</b>	<b>Prob</b>
Pillai trace	0/060	2/721	4	171	0/031
Wilks' lambda	0/940	2/721	4	171	0/031
Hotelling trace	0/064	2/721	4	171	0/031
Roy's Greatest Root	0/064	2/721	4	171	0/031

Post hoc tests were used to respond the question that the mean of which one of goals' dimensions in two experimental and control group have significant difference. Table 5 indicates the result of testing assumption of equality of mean of achievement goals' dimensions in two experimental and control groups done through two-sample t test. It should be mentioned that each of studied variables in this hypothesis has been obtained from the difference between pretest and posttest scores.

Table 6. Testing assumption of equality of mean of achievement goals' dimensions in two control and experimental groups

<b>Components of achievement goals</b>	<b>Testing variance homogeneity of two groups</b>		<b>T test to compare mean of two groups</b>		
	<b>F</b>	<b>Prob value</b>	<b>T</b>	<b>df</b>	<b>Prob value</b>
Performance-approach goal	0/006	0/941	0/628 0/584*	174 37/5	0/531 0/562
performance-avoidance	1/685	0/196	-1/248	174	0/214

goal			-1/133*	36/7	0/265
Mastery-avoidance goal	0/705	0/402	-0/740	174	0/460
			-0/675*	36/9	0/504
Mastery-approach goal	3/057	0/082	-3/190	174	0/002
			03/243*	40/5	0/002

\*assumption of non-homogeneity of variance of two groups.

## 6. Discussion and Conclusion

Teachers are determining factors of successful educational change within education and training system so that promotion of teachers through education is a method to access to optimal and successful educational changes. According to the role of teachers in educational systems, implementation of programs is an undeniable necessity to increase motivation, achievement and attempt of teachers making them search for challenging tasks. Hence, this study was conducted to examine the effect of educational package on achievement goals of student teachers. According to the obtained result, the mean difference between pretest and posttest scores of experimental group was significantly more than control group in terms of mastery-approach goal (mastery-oriented). This difference was not significant for other variables in two experimental and control groups. The results of this study have been coordinated with obtained results from conducted studies by Han and Wang (2016), Lazowski and Hulleman (2016), Boyd (2016), Daniels (2015), Chadwick and Raver (2015), Ikeda et al. (2015), Laine and Gegenfurtner (2013), Johnson and Kestler (2013), Tuominen-Soini et al. (2012), Butler and Shibaz (2008), and Duatepe (2004) indicating the positive relationship between mastery-approach and other effective motivational, emotional and cognitive factors on learning.

Learners who follow mastery-approach direction, have higher self-efficacy level, consider learning tasks as interesting, important and motivational assignments, have a positive attitude toward learning process and positive relationship with use of deep cognitive strategies, appropriate goal setting, self-regulation learning, efficient and appropriate cope with problems and failures, and mastery over tasks (Fryer, 2010; Kudo et al., 2012; Muis & Edwards, 2009; Ames, 1992; Wolters, Yoo, & Pintrich, 1996, 2000; Dweck, 1986; Church, Elliot, & Gable, 2001; Elliot & McGregor, 2001; Daniels et al., 2008; Lee et al., 2010; Kaplan & Flum, 2010; Tuominen-Soini et al., 2011; Dweck, 1986). The result of conducted study of Pintrich (2000) indicated that these learners enjoy learning process, experience positive feelings during learning times so that they are sure about their success in learning process. Therefore, increase in mastery-approach would lead to increase in learners' beliefs about the success level can be achieved from academic activities. Such learners strive to increase their abilities emphasizing on perception, vision and skill.

Therefore, since mastery-approach is related to the tendency of learners to access to the content or mastery over academic skills (Ames, 1992; Pintrich, 2000; Daniels et al., 2008), mastery-oriented learners will be satisfied with learning if they achieve mastery over their assignments. It is recommended for education and training authorities to use this educational package. In addition to relevant limitations to the nature of experimental researches, the relevant limitations to sample group existed in this study; hence, it is suggested for further studies preparing field for gender comparison and choosing larger sample size including two female and male genders from different regions in order to strengthen research findings that can be used by all teachers such as student teacher or in-service teachers. On the other hand, it is suggested carrying out some studies with the aim of examining the effect of educational package on achievement goals of students of three academic levels to generalize the results of present study to all academic levels in order to identify talents of intellectual capitals of future generation so that cognitive ability of students is controlled by some specific educational strategies.

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