

# **ANDRAGOGIC LEARNING PRINCIPLES AND THE MARITIME STUDENTS' PERCEPTIONS ON UNIVERSITY EDUCATION**

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## **ABSTRACT**

Universities offer universal education services to both undergraduate and graduate students in several disciplines. The developments in science and technology have been reflected in education and new methodologies have been developed. In contrast to the instructor centered conventional education systems, andragogical approach considers the student as an active element of the learning process. "Active learning" is one of these systems and it uses "problem based learning-PBL" as a means of learning.

The highly international and technical character of maritime education presents the maritime universities with the responsibility of developing the education systems in conjunction with the latest methodologies applied in education science.

This study aims to analyze to what extent andragogical learning principles are applied in conventional undergraduate education systems. A comparative analysis was covered among maritime students following (1) conventional education systems and (2) active learning systems. Perceptions of the students of the Maritime Business Administration and Deck disciplines have been collected and discussed.

**Key Words:** Andragogy, Active-Learning, Problem-Based Learning, Maritime Education.

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## **1. INTRODUCTION**

Andragogy is the art and science of helping adults learn, and facilitating self-directed teaming. This is in contrast with pedagogy, the art and science of teaching children (Henschke 1998). Traditionally it was assumed that the purpose of education was to produce a knowledgeable person. This assumption was based on the faith that if we just pour enough knowledge into people they will be able to apply this knowledge in dealing with real life problems later in life (Knowles 1979). However starting from the 1980's through the works of education scientists and practitioners, the purpose of adult education has been based on five major assumptions (Knowles 1979, Knowles 1980, Houser 1985, Bolton 1985):

- (1) Adult learners are self-directing,
- (2) Adults' life experiences are a fundamental educational resource,
- (3) Adults' readiness to learn is predicted on perceived needs,
- (4) Adult education must be oriented around current tasks and problems,
- (5) Adults' motivation to learn is predominantly intrinsic, e.g., self-esteem, meaningful life.

In contrast to the pedagogical educational model, which basically requires a content curricular plan, the andragogical approach entails process design, which consists of seven elements (Knowles 1979, Knowles 1980, Houser 1985, Bolton 1985):

- (1) Climate setting based on mutual respect, collaborativeness, mutual trust, supportiveness, openness, authenticity, pleasure and humanness,
- (2) Involving learners in mutual planning,
- (3) Involving participants in diagnosing their own needs for learning,
- (4) Involving learners in formulating their learning objectives,
- (5) Involving learners in designing learning plans,
- (6) Helping learners carry out their learning plans,
- (7) Involving learners in evaluating their own learning.

When previous research on education is considered in the business context, it is seen that the problems of education have been approached from a variety of points. Business and marketing scientists have examined the matter from the point of "Product Life Cycle" and have discussed the linkages to the success of the companies in the education markets (Ottosson and Wang 1997, Madsen and Larsen 1998, Mazzarol 1996, Nicholls 1995). The rapid changes in the logistics and transportation industries have affected educational research also (Alvarstein et al 2001, Gudmundsson and Nijhuis 2001). In the Problem Based Learning field, several researches have discussed the possibilities of applying the system to various disciplines (Choy et al 2003, Laughton and 1998, Perrenet et al 2000, Raachel 2002, Stonyer and Marshall 2002).

Regarding the maritime discipline, two separate areas of research appear: Maritime business and maritime education and training (MET) fields. The former follows the approaches in the business discipline, however the latter concentrates on the education and training of seagoing officers. The importance of employment considerations in the decisions of students to enroll on undergraduate courses in maritime business has been a subject of research among students (Dinwoodie 2000).

Through the works of International Maritime Lecturers' Association (IMLA) and International Association of Maritime Universities (IAMU) research on MET and the student perceptions have been analyzed from various aspects ([www.wmu.se/imla](http://www.wmu.se/imla) and [www.iamu-edu.org/main.asp](http://www.iamu-edu.org/main.asp)).

Considering the problem-based learning in MET, the history of research goes back to 1998 (Teel 1998). Teel's works examine PBL curriculum and simulation based education in maritime transport as the examples of active learning (Teel, 1998; Teel 1999). Later Dokuz Eylul University School of Maritime Business and Management started applying PBL in MET in 2002 and this was reflected in a series of researches to examine several aspects of the system especially through the perceptions of cadets (Paker and Kalkan 2002, Tuna et al 2002, Nas 2003, Asyali et al 2003). Regarding the andragogical determinants, comparative studies among groups of maritime business students and cadets exposed to conventional education or active learning have not yet been encountered.

## **2. OBJECTIVE**

The highly internationalized character of the maritime industry has ended in educational trends and responsibilities of similar international nature. The expectations from the graduates of the maritime universities are similar worldwide and so are their curriculums. The rapid global technological and economical changes have been reflected in the education science and a new definition of the adult education has appeared: Andragogy. For a highly internationalized industry the human resources should be well equipped with problem solving skills and self-directing.

The main objective of this study is to analyze the andragogical determinants among groups of maritime business students and cadets exposed to conventional education or active learning comparatively. To assist internationally applicable results, it is proposed to carry out the study in two different populations, and to end with comparative results in the mentioned andragogical determinants. The analysis is accomplished in two different samples of students: Maritime business students and Deck students. Furthermore both of these samples are split in themselves as students of "conventional education" and "active learning" and the andragogical variables are again tested for both of the two different departments and the school as a whole.

The objectives of the study are included in the following statements:

1. To test each sample with differing educational systems comparatively with respect to the andragogical determinants.
2. To test the whole population with differing educational systems comparatively with respect to the andragogical determinants.
3. To measure the level of importance of each specific variable to the student.

## **3. HYPOTHESES**

Two main hypotheses are developed to test the objectives built on the comparative analysis of the populations:

- H<sub>1</sub>** : Andragogical determinants are perceived different by students of different educational systems in different undergraduate departments of the same institute.
- H<sub>2</sub>** : Andragogical determinants are perceived different by students of different educational systems in the same undergraduate institute.

For each of the hypothesis 23 sub-hypotheses are formulated to analyze the determinants comparatively (**Table 2**).

## 4. METHODOLOGY

### 4.1. Questionnaire Development

To test the hypothesis of the research, a questionnaire consisting of 2 different parts is developed. The first part covers 8 open-ended and multiple-choice questions on the information about the student for the purpose of profile establishment. The second part covers totally 23 statements on andragogic variables on a 5-point Likert-scale (1=strongly disagree, 5=strongly agree) and the opinions of the students are proposed to be collected. Two blank statements have been added to collect the comments in an open-ended way.

### 4.2. Sample

Dokuz Eylul University (DEU) School of Maritime Business and Management (SMBM) was founded in 1988 and provides undergraduate education in two departments; Maritime Business Administration (MarBA) and Deck, where the aim of the Deck Department is to educate oceangoing masters. Led by the Faculty of Medicine six years ago, School of Nursing, Faculty of Law, Faculty of Arts and Sciences, Faculty of Theology and Faculty of Engineering have adopted PBL learning approach in Dokuz Eylul University. SMBM has decided to implement this new approach in its curriculum for both departments starting from the academic year of 2002-2003. In this manner SMBM is the only maritime school applying active learning and PBL in an integrated and modular way where every learning activity is supported by feedbacks individually. Freshman and sophomore students of the two departments follow active learning curriculum, whereas juniors and seniors are subject to conventional education. All of the students in the freshman, sophomore, junior and senior classes of the two departments, namely a total of 360 students have constituted the sample of the study (200 students from the MarBA Department and 160 students from the Deck Department).

The research was carried out during the finals/assessments in February 2004. Although all of the students were included in the population, due to the irregularities of some of the students a total of 308 (85.6% response rate) questionnaires were received, 161 from the MarBA Department and 147 from the Deck Department.

### 4.3. Data Analysis Procedures

The research covers a comparative analysis and the analysis procedures for the data are selected accordingly. Data processing is maintained by the SPSS (Statistical Package for the Social Sciences) Program. Statements based on open-ended and multiple-choice questions ending in nominal data are initially analyzed by relative frequencies. Means for the sample sizes and the standard deviations are also calculated and these are used as a basis for the comparative analysis. Hypotheses based on Likert-scale questions, ending in interval data, are comparatively analyzed using t-tests.

## 5. Evaluation and Results

51.6% of the whole population of the students (n=159) were at the active learning curriculum and 48.4% (n=149) were exposed to the conventional program. The proportions were similar for the students of the MarBA (48.4%/51.6%) and for the Deck (55.1%/44.9%) Departments (**Table 1**).

### 5.1. Student Profile

The profiles of the students are summarized in **Table 1**. Freshman and senior students dominate in SMBM (each having a share of 31.5%) whereas sophomores and juniors are lower in numbers (20.1% and 16.9% respectively). Males account for three quarters of the population (76.3%). State high school graduates were 48.5% and the graduates of the

Anatolian High Schools (where medium of instruction includes an English language support) were 40.9%. 48.3% of the students consider the level of their expenditures as moderate. 39.1% of the students are from Izmir and 9.4% are from Istanbul. Most of the students seem to arrive from the Aegean and Mediterranean cities and this is in compliance with the fact that SMBM is the only maritime undergraduate institute of these two regions.

**Table 1.** Profile of the Respondents

Variable	Dept. of Maritime Buss. Adm.		Dept. of Deck		School of Maritime Buss. and Man.	
	n	Percent,%	n	Percent,%	n	Percent,%
<b>Class</b>						
Freshman	50	31.1	47	32.0	97	31.5
Sophomore	28	17.4	34	23.1	62	20.1
Junior	20	12.4	32	21.8	52	16.9
Senior	63	39.1	34	23.1	97	31.5
Missing	--	--	--	--	--	--
Total*	161	100.0	147	100.0	308	100.0
<b>Education</b>						
Active Learning	78	48.4	81	55.1	159	51.6
Conventional Education	83	51.6	66	44.9	149	48.4
Missing	--	--	--	--	--	--
Total*	161	100.0	147	100.0	308	100.0
<b>Gender</b>						
Male	89	56.0	142	96.6	229	76.3
Female	70	44.0	5	3.4	71	23.7
Missing	2	--	--	--	8	--
Total*	161	100.0	147	100.0	308	100.0
<b>High School</b>						
State High School	76	47.5	71	49.7	147	48.5
Anatolian High School	72	45.0	52	36.4	124	40.9
Vocational High School	3	1.9	19	13.3	22	7.3
Private High School	9	5.6	1	0.7	10	3.3
Missing	1	--	4	--	5	--
Total*	161	100.0	147	100.0	308	100.0
<b>Original City</b>						
Izmir	68	46.9	44	32.4	112	39.1
Istanbul	10	6.9	17	12.5	27	9.4
Balikesir	9	6.2	8	5.9	17	5.6
Aydin	12	8.3	4	2.9	16	5.6
Ankara	4	2.8	7	5.1	11	3.9
Hatay	4	2.8	5	3.7	9	3.2
Icel	1	0.7	7	5.1	8	2.8
Antalya	--	--	6	4.4	6	2.2
Ordu	1	0.7	5	3.7	6	2.2
Denizli	4	2.8	1	0.7	5	1.9
Manisa	4	2.8	--	--	4	1.4
Others	33	21.2	32	23.6	65	22.7
Missing	11	--	11	--	22	--
Total*	161	100.0	147	100.0	308	100.0

\* Missing cases are not included in the relative frequencies

## 5. 2. Results of the Hypotheses Tests

The two main hypotheses of the study aimed searching for the analysis of measures of andragogical determinants in two aspects; the departments and the whole School: The determinants, (1) being perceived different by students of different educational systems in different undergraduate departments of the same institute, and (2) being perceived different by students of different educational systems in the same undergraduate institute.

*Tests for  $H_1$  :*

Results of the tests for  $H_1$  regarding the perceptions of students of different educational systems (namely conventional system and active learning) in different undergraduate departments (namely Maritime Business Administration-MarBA and Deck) of the same institute (School of Maritime Business and Management) are summarized in the first two columns of **Table 2**.

**Table 2.** Analysis of Andragogical Determinants among Maritime Students of Active and Conventional Learning Systems: Results of the Hypotheses Tests for  $H_1$  and  $H_2$

Hypothesis	Support*		
	Dept. of Mar. Bus. Adm.	Dept. of Deck	School of Mar. Bus. & Man.
H <sub>11-21</sub> : Students are aware of the objectives and goals of the system	Not supported	Not supported	Not supported
H <sub>12-22</sub> : Students set the learning objectives	<b>Supported</b> t=4.7794	<b>Supported</b> t=5.8754	<b>Supported</b> t=7.6373
H <sub>13-23</sub> : Social needs are supported by the system	Not supported	Not supported	Not supported
H <sub>14-24</sub> : Educational environment supports learning	Not supported	<b>Supported</b> t=-2.7829	Not supported
H <sub>15-25</sub> : Various educational methodologies and techniques are applied	Not supported	Not supported	Not supported
H <sub>16-26</sub> : Time given to achieve the learning objectives is adequate	Not supported	<b>Supported</b> t=-3.3539	<b>Supported</b> t=-3.0603
H <sub>17-27</sub> : The topics learnt in the starting years of the education are (not) forgotten later	Not supported	Not supported	Not supported
H <sub>18-28</sub> : The topics learnt in the starting years of the education are easier and they get more difficult later	<b>Supported</b> t=6.0035	<b>Supported</b> t=2.1508	<b>Supported</b> t=5.6323
H <sub>19-29</sub> : The knowledge received from different subjects can be integrated	Not supported	<b>Supported</b> t=-2.5486	<b>Supported</b> t=-2.2750
H <sub>110-210</sub> : Feedbacks support the learning process	<b>Supported</b> t=-5.0999	<b>Supported</b> t=-4.5369	<b>Supported</b> t=-6.7212
H <sub>111-211</sub> : Assessments support the learning process	Not supported	Not supported	Not supported
H <sub>112-212</sub> : New requirements of the society and the profession are reflected to the curriculums in the shortest time	Not supported	Not supported	Not supported
H <sub>113-213</sub> : If the motivation of the student falls academics and friends provide support	<b>Supported</b> t=-2.9180	Not supported	<b>Supported</b> t=-2.0952
H <sub>114-214</sub> : The most important motivational factor in education is self-confidence of the student	Not supported	<b>Supported</b> t=-2.5515	Not supported
H <sub>115-215</sub> : The subjects that receive high attention are the ones that create interest, happiness and solutions to the problems	Not supported	Not supported	Not supported
H <sub>116-216</sub> : System develops problem solving skills	<b>Supported</b> t=2.9169	Not supported	Not supported
H <sub>117-217</sub> : System develops self learning skills	<b>Supported</b> t=3.3101	Not supported	<b>Supported</b> t=2.8409
H <sub>118-218</sub> : The students decide freely what to learn to what extent	Not supported	Not supported	Not supported
H <sub>119-219</sub> : Setting the learning objectives themselves and researching them let the students gain experience	Not supported	Not supported	Not supported
H <sub>120-220</sub> : The students decide the depth of the research for the learning objectives	Not supported	Not supported	Not supported
H <sub>121-221</sub> : The system groups the students according to their interests	Not supported	Not supported	Not supported
H <sub>122-222</sub> : The students and the instructors are the equal partners of the system	Not supported	Not supported	<b>Supported</b> t=2.1241
H <sub>123-223</sub> : The students are active partners of the system	<b>Supported</b> t=2.7257	<b>Supported</b> t=3.8901	<b>Supported</b> t=4.6606

\* Method of analysis is t-test,  $p < 0.05$

For the MarBA department among the hypothesized variables  $H_{12}$ ,  $H_{18}$ ,  $H_{110}$ ,  $H_{113}$ ,  $H_{116}$ ,  $H_{117}$ ,  $H_{123}$  are confirmed. This means that the MarBA students subject to different educational systems consider the following determinants different: (1) Students' role in setting the learning objectives, (2) The topics learnt in the starting years being easier than the coming years, (3) Feedbacks' support in the learning process, (4) Support of academics and friends when the motivation of the student falls, (5) Education system's role in development of problem solving skills, (6) Education system's role in development of self learning skills, and (7) Students' positions as the active partners of the education system. For the Deck department among the hypothesized variables  $H_{12}$ ,  $H_{14}$ ,  $H_{16}$ ,  $H_{18}$ ,  $H_{19}$ ,  $H_{110}$ ,  $H_{114}$ ,  $H_{123}$  are confirmed. This means that the Deck students subject to different educational systems consider the following determinants different: (1) Students' role in setting the learning objectives, (2) Educational environment's support in the learning process (3) Adequacy of time in achieving the learning objectives, (4) The topics learnt in the starting years being easier than the coming years, (5) Integration of knowledge given in different subjects, (6) Feedbacks' support in the learning process, (7) Role of self-confidence on the motivation of the student, and (8) Students' positions as the active partners of the education system.

*Tests for  $H_2$  :*

Results of the tests for  $H_2$  regarding the perceptions of students of the same institute (School of Maritime Business and Management-SMBM) subject to different educational systems (namely conventional system and active learning) are summarized in the third column of **Table 2**. For the SMBM among the hypothesized variables  $H_{12}$ ,  $H_{16}$ ,  $H_{18}$ ,  $H_{19}$ ,  $H_{110}$ ,  $H_{113}$ ,  $H_{117}$ ,  $H_{122}$ ,  $H_{123}$  are confirmed. This means that the SMBM students subject to different educational systems consider the following determinants different: (1) Students' role in setting the learning objectives, (2) Adequacy of time in achieving the learning objectives, (3) The topics learnt in the starting years being easier than the coming years, (4) Integration of knowledge given in different subjects, (5) Feedbacks' support in the learning process, (6) Support of academics and friends when the motivation of the student falls, (7) Education system's role in development of self learning skills, (8) Students and instructors being equal partners of the system, and (9) Students' positions as the active partners of the education system.

Among the total of nine variables that have appeared in either of the samples, four of them have been repeated in both of the departments and the SMBM. These are  $H_{12}$  (students' role in setting the learning objectives),  $H_{18}$  (the topics learnt in the starting years being easier than the coming years),  $H_{110}$  (feedbacks' support in the learning process) and  $H_{123}$  (students' positions as the active partners of the education system). Among these  $H_{18}$  may be neglected due to the fact that the two groups are already from different years of the education. Students' roles in setting the learning objectives, importance of feedbacks and the position of the students in the system are the leading characteristics of the active learning system and these have been repeatedly confirmed for all the populations. Besides, the effects of the system in developing problem-solving and self-learning skills and integration of the knowledge have also been proved through the study.

To analyze the findings further, frequencies of responses of the whole population of the SMBM students for the statements on andragogical learning are checked as means and standards deviations and the results are given in **Appendix 1** as **Table A1** and **Figure A1**. The table and the figure help in determining the approaches discussed above, such that the frequencies differ considerably for determining the learning objectives (2), effects of the feedbacks(10), system's support in developing the problem-solving (16) and self-learning (17) skills, instructors and the students being equal partners of the system (22) and the students being active partners of the system (23).

## 6. CONCLUSION

Education scientists and practitioners have summarized the distinctive purposes of adult education as self-directing, basing on life experiences, orientation around current tasks and problems and predominantly intrinsic motivation to learn. In contrast to the pedagogical education that requires a content curricular plan, andragogical approach includes learners in every step of the process as planners, formulators of the objectives, followers of the plans and evaluators of the system. In the latter, the system is based on mutual respect, collaborativeness, mutual trust, supportiveness, openness, authenticity, pleasure and humanness.

Maritime education and training is serving an industry the system of which is totally international, highly regulated, the actors dealing with complex and integrated global problems in all disciplines. The graduates of maritime undergraduate programs need to be equipped with highly developed problem solving skills against integrated problems, self-confidence, teamwork skills, self-assessment and intrinsic motivation to learn.

The study has proven that the highlighted expectations from andragogical approach are captured by the active learning system. Students' roles in setting the learning objectives, importance of feedbacks and the active position of the students in the system are the leading characteristics of the active learning system and these have been repeatedly confirmed for all the populations that were included in the study. The influence of the system in developing problem-solving and self-learning skills and integration of the knowledge has also been proved through the study.

The schools of medicine and nursery have widely applied active learning worldwide. SMBM's practice is the first application in the maritime education and training field. In this sense the outcomes of this study are contributing to the theory of adult learning in general and to the undergraduate education in the maritime discipline in particular. With the highly increasing importance of human resources in the most internationalized and technical maritime field, it is the duty of maritime scientists and instructors to develop the educational methodologies according to the requirements of the education and maritime sciences and the maritime markets and businesses.

### *Limitations and Further Research*

The study has been applied to the students of only one school, since SMBM has been the only undergraduate institute in this field. The research may be repeated with students of different disciplines who are subject to active learning and also with other maritime students subject to conventional education and comparative results may be searched. International populations should be established to reach internationally applicable results.

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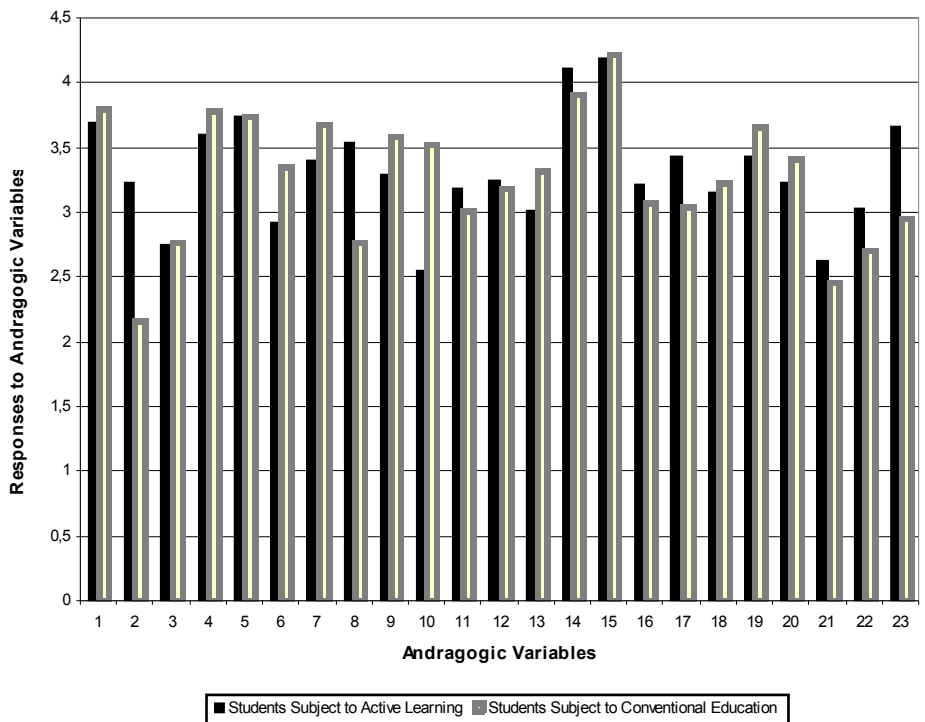
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**Appendix1**



**Figure A1.** Frequency of Responses to the Andragogic Variables for the Whole Population of Students- Conventional versus Active Learning Systems

**Table A1.** Frequencies of Responses for the Statements on Andragogical Learning

Statements	Group*	Dept. of Maritime Buss. Adm.			Dept. of Deck			School of Mar. Buss. and Man.		
		n	Mean**	SD**	n	Mean**	SD**	n	Mean**	SD**
H <sub>11</sub> : Awareness of the objectives and goals	1	78	3.6923	1.1085	81	3.7037	1.1341	159	3.6981	1.1181
	2	81	3.6914	1.0325	66	3.9394	1.1077	147	3.8027	1.0704
H <sub>12</sub> : Students set the learning objectives	1	78	3.1154	1.3768	80	3.3500	1.2936	158	3.2342	1.3363
	2	83	2.1687	1.133	66	2.1515	1.1401	149	2.1611	1.1215
H <sub>13</sub> : Support to the social needs	1	78	2.9103	1.2294	80	2.6000	1.3834	158	2.7532	1.3147
	2	82	2.7927	1.3401	63	2.7460	1.2822	145	2.7724	1.3110
H <sub>14</sub> : Educational environment supports learning	1	77	3.7143	1.1222	81	3.4938	1.0738	158	3.6013	1.0997
	2	83	3.6386	1.0544	66	3.9697	.9762	149	3.7852	1.0304
H <sub>15</sub> : Methodologies and techniques applied	1	78	3.7564	1.0591	80	3.7250	1.1021	158	3.7405	1.0777
	2	83	3.6627	.9788	63	3.8413	1.1388	146	3.7397	1.0508
H <sub>16</sub> : Adequate time for the learning objectives	1	77	2.9481	1.2555	80	2.9125	1.2242	157	2.9299	1.2358
	2	83	3.1928	1.2342	63	3.5714	1.0883	146	3.3562	1.1846
H <sub>17</sub> : Topics learnt in the starting years (not) forgotten later	1	72	3.4306	1.2427	76	3.3684	1.1982	148	3.3986	1.2163
	2	82	3.6463	1.3368	64	3.7188	1.1051	146	3.6781	1.2370
H <sub>18</sub> : Topics learnt in the starting years easier	1	76	3.8421	1.1553	80	3.2625	1.1445	156	3.5449	1.1824
	2	83	2.7108	1.2150	65	2.8308	1.2695	148	2.7635	1.2364
H <sub>19</sub> : Knowledge received from different subjects can be integrated	1	78	3.2949	1.1294	81	3.2840	1.1318	159	3.2893	1.1270
	2	83	3.4578	1.2327	65	3.7538	1.0757	148	3.5878	1.1718
H <sub>110</sub> : Feedbacks support the learning process	1	77	2.4156	1.2497	79	2.6835	1.2252	156	2.5513	1.2407
	2	80	3.4250	1.2302	65	3.6462	1.3161	145	3.5241	1.697
H <sub>111</sub> : Assessments support the learning process	1	78	3.0641	1.2622	81	3.3086	1.1900	159	3.1887	1.2282
	2	83	2.9518	1.2582	66	3.1061	1.4584	149	3.0201	1.3480
H <sub>112</sub> : New requirements reflected to the curriculums	1	78	3.2179	1.2342	81	3.2716	1.0841	159	3.2453	1.1568
	2	83	2.9277	1.2763	64	3.5313	1.2080	147	3.1905	1.2786
H <sub>113</sub> : Academics and friends support motivation	1	77	2.6883	1.3105	81	3.3333	1.1068	158	3.0190	1.2491
	2	83	3.2892	1.2929	65	3.3692	1.3178	148	3.3243	1.3000
H <sub>114</sub> : Self-confidence for motivation	1	78	4.6795	6.2179	81	3.5556	1.0488	159	4.1069	4.4403
	2	82	3.8293	1.0750	66	4.0000	1.0525	148	3.9054	1.0648
H <sub>115</sub> : Importance of the subjects that create interest, happiness and solutions to the problems	1	78	4.3462	.9234	81	4.0494	.8930	159	4.1950	.9173
	2	81	4.2593	1.0580	66	4.1667	1.1311	147	4.2177	1.0887
H <sub>116</sub> : System develops problem solving skills	1	78	3.4103	1.1216	80	3.0125	1.1528	158	3.2089	1.1513
	2	83	2.8795	1.1832	64	3.3438	1.1981	147	3.0816	1.2079
H <sub>117</sub> : System develops self learning skills	1	75	3.4667	1.0946	76	3.3947	1.1785	151	3.4305	1.1344
	2	81	2.519	1.2156	66	3.2727	1.2222	147	3.0408	1.2324
H <sub>118</sub> : The students decide what to learn to what extent	1	78	3.0769	1.2970	80	3.2375	1.2038	158	3.1582	1.2493
	2	83	3.1566	1.3658	63	3.3333	1.4811	146	3.2329	1.4144
H <sub>119</sub> : Students gain experience by self learning	1	78	3.4103	1.2425	81	3.4444	1.0724	159	3.4277	1.1554
	2	83	3.6386	1.1747	66	3.6818	1.2046	149	3.6577	1.1842
H <sub>120</sub> : The students decide the depth of the research	1	78	3.1410	1.3263	81	3.3086	1.2108	159	3.2264	1.2675
	2	83	3.3494	1.1200	66	3.5000	1.1800	149	3.4161	1.1455
H <sub>121</sub> : The system groups the students according to their interests	1	76	2.5395	1.1128	79	2.7215	1.1540	155	2.6323	1.1340
	2	82	2.3659	1.1057	66	2.5606	1.3602	148	2.4527	1.2252
H <sub>122</sub> : The students and the instructors are equal	1	78	3.1154	1.3955	79	2.9494	1.1972	157	3.0318	1.2980
	2	82	2.6951	1.3761	66	2.7121	1.4440	148	2.7027	1.4019
H <sub>123</sub> : The students are active partners of the system	1	78	3.5641	1.4012	79	3.7595	1.1681	157	3.6624	1.2888
	2	83	2.9639	1.3920	66	2.9242	1.4176	149	2.9463	1.3988

\* 1: Active learning group, 2: Conventional education group

\*\* 5-point Likert scale- 1: Completely Disagree, 5: Completely Agree, SD: Standard Deviation