

How Individual Learning Styles Affect The Medium Of Instruction At Problem-Based Discussion Sessions : Analyzing The Effects Of Vark Preferences At A Higher Maritime Education And Training (Met) Institution

Mustafa Kalkan*

ABSTRACT

The purpose of this study is two-fold: the first aim is analyzing any likely effects of the problem-based discussion sessions on promoting the cognitive, affective and psychomotor domains; and the second aim is discovering the effects, of the individual learning preferences on the above stated promotion. Considering the prevailing individual learning preferences is likely to help instructors preside over problem-based discussion sessions more effectively. The instrument of the research is a questionnaire consisting of two sets each of which is assumed to provide data for one of the two-fold aims. The first set of the questionnaire is based on the "Higher-Order Thinking and Problem Solving Checklist" (Borich, 2004:294). "The second set of questionnaire comprises 13 statements derived from VARK- a guide to learning styles, aiming to reveal the "preferences of each learner about the ways to take-in and give-out information while learning" (Fleming, 2001).

The two sets of questionnaires are conducted through the students of Department of Nautical Science at Dokuz Eylül University School of Maritime Business and Management, where Problem-Based Learning Method (PBL) has been employed for the last five years.

The data gained show that PBL discussion sessions contribute to promoting cognitive and metacognitive domains and also that the prevailing individual learning preference at the randomly chosen sample is kinesthetics, learning through self-practicing and self-experiencing

Keywords: Problem-based learning, cognition, metacognition, learning styles, Vark

ÖZET

Bu çalışma, bilişsel, duyuşsal ve bedensel becerilerin gelişiminde probleme dayalı tartışma oturumlarının ve bireysel öğrenme tercihlerinin katkılarını incelemektedir. En yaygın öğrenme tercihinin dikkate alınması probleme dayalı tartışma oturumlarının daha etkin yönlendirilmesine yardımcı olacaktır. İncelemede iki takımdan oluşan bir anket uygulanmaktadır. Takımlardan biri probleme dayalı tartışma oturumlarının, ikincisi de bireysel öğrenme tercihlerinin sözü edilen becerilerin gelişimindeki etkisine ilişkindir. İlk takımda, "Yüksek Düzeyli Düşünme ve Problem Çözme Becerileri Listesi" (Borich, 2004:294), ikinci takımda, "Öğrenirken Bilgi Edinimi ve Aktarımına İlişkin Her Bir Öğrencinin Tercihlerini" ortaya çıkarmayı amaçlayan ve 13 ifadeden oluşan VARK anketi (Fleming 2001) kullanılmaktadır.

İki takımdan oluşan anket, beş yıldır probleme dayalı öğrenme (PDÖ) yöntemi uygulayan DEÜ Deniz İşletmeciliği ve Yönetimi Yüksekokulu Güverte Bölümü öğrencileri arasında uygulanmıştır.

Araştırmanın verilerinden, PDÖ tartışma oturumlarının bilişsel ve bilişüstü becerilerin gelişimine katkıda bulunduğu ve örneklem grubunda en yaygın öğrenme tercihinin yaparak ve yaşayarak öğrenme olduğu anlaşılmıştır..

Anahtar Kelimeler: Probleme dayalı öğrenme, bilişsel, bilişüstü, öğrenme fikirleri, Vark

* Mustafa Kalkan Yrd.Doç.Dr., DEU School of Maritime Business and Management, Tınaztepe Campus, 35160, Buca, İzmir/Turkey,

1. Problem-Based Learning and Discussion Sessions

A student-centered active learning method, problem-based learning is thought to improve the ability to solve problems using the pre-existing knowledge on the subject in question as well as the clues provided through well-designed scenarios composed of real or near-real life situations (Kaufman 2000:510; Albanese and Mitchel, 1993:50; Schmidt, 1990:3 and 1983:11). While working on the problems provided and tackling them with the pre-knowledge, learners are thought to acquire new knowledge through the learning objectives they are supposed to set themselves. Barrows and Tonblyn (1980:91) remind that the basic stimulation, in this method, lies in the problem designed; and that the basis of the method is the freedom in asking questions, developing hypotheses and setting learning objectives; also that problems act as locomotives of the whole system.

The very first step of the method is the discussion sessions where the scenario is thoroughly discussed, difficulties clarified, the problem defined, the problem analyzed and hypotheses created and schematized, learning objectives set, and following individual search and self-directed study, the new data collected and synthesized (Schmidt, 1983:11-16 and 1990:2; Gilbert and Fester, 1994:245) and hence through each session, certain new knowledge is gained as per the paces previously designed and planned by the faculty.

The contributions of such discussion sessions in terms of gaining knowledge, skills and attitudes are analyzed by Barrows and Myers (1998:1-7) in six dimensions as follows: Scientific method (developing hypotheses, synthesizing new information, setting learning objectives), cognitive flexibility and integration (referring to various sources, self-instructed study, integrating new information with the scenario), life-long learning (steady rise in need of learning, recognizing the need for additional information, effective use of materials and sources, critical analysis on the sources, seeking means for effective use of the new information/data collected), cooperation in teamwork (improving self-confidence and independent participation, sharing perceptions, approaches, knowledge, skills and experience) liability for self and others (acting in favor of group dynamism, arranging behaviors, utilizing time and resources), and self assesment

(evaluating self in terms of contributions to the discussion sessions).

Albanase (2000:729-738) points out the cognitive and motivative effects of the PBL discussion sessions on forming, developing, sustaining any targeted knowledge, skills and attitudes. The cognitive elaboration is attributed, in this study, to the interpersonal relations, discussions, presentations, listening, correcting one another, asking and answering questions, explaining to one another, and drawing conclusions. The motivative effects are attributed to encouraging the individual members of the group, establishing social cohesion and improving team spirits. The overall effects are highlighted in Albanase's study under such topics as context, cooperation, information process, self determination and control theory. Dolmans, Wolfhagen and Van Der Vleuten (1998:22-24), distinguish the effects of PBL discussion sessions within four major theoretical perspectives which are highlighted as motivational, social cohesiveness, developmental perspective and cognitive elaboration.

2. The Importance of Learning Styles and Preferences

"It is not easy to penetrate the private world of someone coming to an understanding of an idea...I once caught myself wishing I could attach electrodes to students' heads to see what goes on when they learn." says Laurillard (1993:48) and adds, "We need a methodology that provides a deep level of description of what is happening for the students when they learn, linking the way they think about the content to what they achieve as an outcome." These quotations clearly emphasize the crucial importance of arranging the teaching/learning environments and means in compliance with learning styles and preferences of the learners.

2.1. The Features of Styles and Preferences

The learning styles and preferences adopted by each individual in a discussion group are, however, likely to diversify rather immensely. Besides, there might be many other factors both affecting and being affected by the styles and/or preferences. "Involvement in group discussions", for instance, "depends on a myriad of factors, such as: the student's level of self-confidence; interest in the subject; mood and feeling on the day; level of preparedness; group size; familiarity with others in the group; perceptions of the tutor's attitude and

approachability; and perceptions of the relevance of the discussion.” (Evans and Abbott, 1998:54). Put together, such factors are expected to affect the attitudes of learners towards the small group discussion sessions and eventually various *likes* as well as *dislikes* appear.

2.2 Visual/Aural/Reading-Writing/Kinesthetic (VARK)

Individuals are thought to develop certain learning styles that are most likely to affect their achievements in all learning activities they get involved. In order to get some idea about the preferences of the individual, which dominate their learning, a questionnaire called VARK has been developed by Neil Fleming. VARK, which stands for Visual, Aural, Read-Write and Kinesthetic, “provides users with a profile of their preferences. These preferences are about the ways that they want to take-in and give-out information whilst learning” (Fleming, 2001).

3. Research on Learning Preferences

In this research, VARK QUESTIONNAIRE prepared by Neil Fleming was used. VARK, a guide to and an important part of learning styles, stands for Visual-Aural-Reading/Writing-Kinesthetic. The *visual study preference* primarily covers the means appealing to eyes and seeing; the *aural preference* is focused on hearing; *reading/writing preference* emphasizes the activities involving *reading and writing*; and *the kinesthetic preference*, such activities as feeling, touching, practicing and fulfilling (performing) any tasks requiring certain physical skills and efforts.

3.1. The Aim of the Research

The research aims at finding out the dominating learning preferences of the learners studying at Izmir Dokuz Eylul University School of Maritime Business and Management, Department of Nautical Science. Having some concrete idea about the learning preferences is thought to help to make certain changes and adjustments with the teaching and learning environments. Hence, the secondary aim of the research is to see whether the dominating learning preferences have any effects on the level of the learners utilizing the problem-based learning (PBL) discussion sessions conducted at the mentioned department.

3.1.1. The Model of the Hypotheses of the Research

The research has been carried out at the higher maritime education institution that has three departments: Department of Maritime Administration, Department of Nautical Science, and Department of Marine Engineering. The research has been conducted through the students studying at the Department of Nautical Science only. The levels of the students who have been subject to the research are indicated in the model as “Term” standing for “Year”.

The conceptual model and the hypotheses of the research could be highlighted as follows(See Figure 1):

H₁: The perceptions of the students on the contributions of the problem-based discussion sessions to their gainings in cognition and metacognition differ with regard to the terms.

H₂: The perceptions of the students on the contributions of the problem-based discussion sessions to their gainings in cognition and metacognition differ with regard to their learning preferences (VARK).

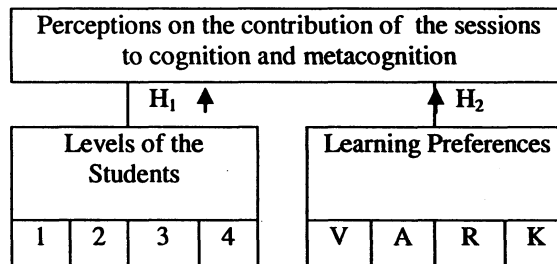


Figure 1. Conceptual Model and Hypotheses of the Research

3.1.2. Data Collection

The data collection instrument is a questionnaire consisting of two sets. One of the sets, aiming at checking H₁, has 62 variables that constitute “Higher-Order Thinking and Problem-Solving Checklist” (Borich,2004:115). In this set, five-point Likert scale is used. The variables of this set are grouped into such subheadings as Application of Knowledge (1-7), Analytical Skills (8-23), Synthesis/Creativity (23-27), Evaluation/Metacognition (28-35), Dispositions (36-56) and Values (57-62). The students were asked to check one of such five choices for each variable as: 5 (Great Extent), 4 (Fair Extent), 3 (Some Extent), 2 (A little) and 1

(Not at all). The second set of the questionnaire, aiming at finding out the learning preferences, comprises 13 variables each of which has four choices. These variables are the Turkish version of the VARK questionnaire (Fleming, 2001) reliability of which has already been secured by the inventor of the questionnaire, from whom the permission to use the questionnaire has been received through e-mail correspondence. The students were asked to check any one or more of the choices. The reason why more than one choice could be checked is that an individual could be apt to prefer more than one mode.

The questionnaires were handed in on Dec.18. through Dec.28, 2006, to the moderators/tutors prior to the beginning and collected at the end of the problem-based discussion sessions. The sample chosen through simple random sampling wherein "the probability of selection into the sample is known and equal for all members of the population"(Burns and Bush, 1995:326) comprises four different groups and is equal to the population. The total number of the questionnaires handed in to the moderators was 193 and totally 128 responses were received, corresponding to an average of 66 percent, as detailed in Table 1.

Table 1. Sample Details

Levels	Handed in	Collected	Response Rate
Term 1	59	46	77.9 %
Term 2	43	24	55.8 %
Term 3	50	27	54.0 %
Term 4	41	31	75.6 %
Total	193	128	66.3 %

3.2. The Results of the Research

The method used in this research is Analysis of Variance (ANOVA, a statistical technique for examining the differences among means for two or more populations).

3.2. 1. The Results of H₁

The variables that have received highly favorable perceptions (over 4.00) could be highlighted as follows (See Table 2):

Application of Knowledge: Communicating the results and consulting a variety of knowledge sources to gather information.

Analytical Skills: Comparing a problem to problems encountered previously, identifying and articulating errors, explaining the reason for conclusion; finding corroborating evidence from among different data sources and placing an interpretation of a problem in the context of prevailing circumstances.

Synthesis / Creativity: Generating new ways of viewing a situation outside the boundaries of standard conventions, brainstorm new applications of content and anticipating potential problems.

Dispositions: Sharing and taking turns, providing assistance to others, engaging in tasks, demonstrating persistence in tackling difficulties, displaying enthusiasm for learning, collaborating with others in team, providing assistance to others when asked, listening attentively to others and setting goals that are achievable.

Values: Maintaining self discipline in dealing with difficult situations, caring and concerning for others and acting responsibly in dealing with tasks and people.

An overall evaluation reveals that there exist significant differences among the perceptions (38 out of 62 items). This fact proves the estimation reflected through H₁.

The variables concerning 'evaluation / metacognition' received over 3.38, corresponding to a moderate extent. Besides, five out of eight items received over 4.00 from the first two terms, and a slight fall appears in the responses gained from the last two. Furthermore, concerning this particular part, the variables for which the perceptions reveal meaningful differences are: making appropriate revisions on the basis of feedback, judging the credibility of evidence, and catching fallacies and contradictions.

Table 2. Perceptions on Cognition and Meta Cognition

Statements	Overall (n=128)	Term 1 (n=46)	Term 2 (n=24)	Term 3 (n=27)	Term 4 (n=31)
1. Search his/her memory for what is already known about a problem.	3.84	3.93	3.96	3.67	3.74
2. Draw a picture or diagram that shows what was learned or observed	3.67	3.76	3.83	3.48	3.58
3. Construct and interpret graphs, charts, tables.	3.87	3.96	4.25	3.54	3.73
4. Classify/categorize things into definable attributes.	3.83	3.98	4.04	3.63	3.65
5. Communicate the results of what was observed in written and oral format.	4.01	4.13	4.29	3.96	3.65
6. Apply given rules to reach a conclusion.	3.84	3.96	4.04	3.63	3.68
7. Consult a variety of knowledge sources to gather information.	4.13	4.35	4.37	3.96	3.74
Table 2. Continued					
Statements	Overall (n=128)	Term 1 (n=46)	Term 2 (n=24)	Term 3 (n=27)	Term 4 (n=31)
8. Identify similarities and differences among various elements.	3.72	3.93	3.96	3.54	3.35
9. Compare a problem with problems encountered before.	4.00	4.22	4.13	3.96	3.61
10. Understand the relationship of each component to the whole.	3.89	4.02	4.17	3.78	3.57
11. Make reasonable conclusions from observation or analysis of data.	3.90	3.98	4.25	3.81	3.58
12. Identify and articulate errors in their own thinking or in that of others.	4.09	4.35	4.30	3.78	3.84
13. Explain the reasons for a conclusion.	4.09	4.28	4.21	3.96	3.81
14. Predict what will happen given the information you have.	3.98	4.33	4.13	3.96	3.35
15. Plan a way to test one's prediction.	3.70	3.91	4.04	3.59	3.23
16. Distinguish the most important elements of a problem.	3.94	3.98	4.33	3.96	3.55
17. Organize a conclusion about a problem in a logical fashion.	3.98	4.17	4.09	3.93	3.65
18. Identify criteria for evaluating a problem solution.	3.77	3.98	3.96	3.63	3.45
19. Gather information or evidence to solve a problem.	4.09	4.37	4.29	3.85	3.74
20. Find corroborating evidence from among different data sources.	4.00	4.35	4.17	3.67	3.65
21. Determine the reliability of the evidence.	3.79	3.83	4.08	3.67	3.61
22. Place an interpretation of a problem in the context of prevailing circumstances.	4.05	4.15	4.50	3.96	3.65
23. Generate a new ways of viewing a situation outside the boundaries of standard conventions.	3.99	4.39	4.17	3.56	3.65
24. Reformulate a problem to make it more manageable.	3.92	3.98	4.21	3.81	3.71
25. Brainstorm new applications of content.	4.07	4.28	4.25	3.81	3.84
26. Anticipate potential problems.	4.04	4.22	4.33	3.81	3.74
27. Accurately summarize what is read or others have said, orally and in writing.	3.96	4.15	4.33	3.54	3.74
28. Ignore distractions that interfere with goal attainment.	3.38	3.35	3.50	3.48	3.26
29. Make appropriate revisions on bases of feedback.	3.78	4.11	4.00	3.33	3.52

30. Assess risks involved in a solution.	3.81	3.96	4.00	3.67	3.57
31. Monitor the outcome and revise a strategy where appropriate.	3.74	3.89	3.96	3.42	3.63
32. Judge the credibility of evidence.	3.80	4.00	4.00	3.56	3.55
33. Evaluate the revise what is written.	3.76	4.00	3.71	3.56	3.63
34. Ask questions to oneself about ideas he/she is unsure of.	3.87	4.00	4.08	3.70	3.65
35. Catch fallacies and contradictions.	3.88	4.13	4.17	3.48	3.65
36. Meaningfully praise the performance of others.	3.66	3.78	3.63	3.67	3.52
37. Share and take turns.	4.07	4.22	4.25	3.85	3.90
38. Help keep others on- task.	3.94	4.13	4.04	4.04	3.48
39. Provide assistance to others when needed.	4.09	4.28	4.13	4.07	3.77
40. Engage in tasks even when answers or solutions are not immediately apparent.	4.03	4.17	4.37	3.92	3.65
41. Seek accuracy.	3.95	4.24	4.04	3.78	3.61
42. Is flexible to change viewpoint to match the facts.	3.96	4.18	4.04	3.89	3.65
43. Demonstrate restraint over impulsive behaviors	3.95	4.00	4.17	3.81	3.84
44. Compose drafts and tryouts in attempts to solve a problem.	3.87	4.00	4.00	3.78	3.67
45. Demonstrate persistence in tackling difficult tasks.	4.06	4.24	4.25	4.04	3.67
46. Use a constructive tone when responding to others.	3.94	4.11	3.96	3.89	3.74
47. Display enthusiasm for learning.	4.04	4.17	4.17	4.07	3.71
48. Ask for feedback when needed.	3.98	4.20	4.17	3.69	3.77
49. Collaborate with others in team.	4.02	4.20	4.29	3.78	3.77
50. Provide assistance to others when asked.	4.13	4.39	4.30	3.89	3.81
51. Demonstrate independence in completing a project.	3.84	3.74	4.25	3.89	3.65
Table 2. Continued					
52. Listen others attentively.	4.06	4.22	4.17	3.88	3.90
53. Ignore distractions that interfere with goal attainment.	3.87	3.96	3.96	3.89	3.65
54. Keep record on one's own progress toward important goals.	3.87	4.04	4.17	3.48	3.71
55. Realistically evaluate own performance.	3.92	3.93	4.21	3.74	3.84
56. Set goals that achievable within a specific span of time.	4.02	4.30	4.13	3.78	3.74
57. Demonstrate awareness of ethical concerns and conflicts	3.84	3.91	4.21	3.74	3.52
58. Adhere to codes of conduct.	3.96	4.17	4.00	3.78	3.77
59. Show an ability to resolve ethical dilemmas and conflicts.	3.99	4.11	4.13	4.07	3.65
60. Maintain self-discipline in dealing with difficult situations.	4.02	4.20	4.25	3.85	3.71
61. Behave in a manner that communicates care and concern for others.	4.01	4.17	4.29	3.70	3.81
62. Act responsibly in dealing with tasks and people.	4.16	4.39	4.42	3.89	3.84

Table 3. Results of the Hypotheses Tests

Sub-Hypotheses	F	Significance	Results
H ₁₁ . Search his/her memory for what is already known about a problem.	0.875	0.456	Not supported
H ₁₂ . Draw a picture or diagram that shows what was learned or observed	0.868	0.460	Not supported
H ₁₃ . Construct and interpret graphs, charts, tables.	2.976	0.034	Supported $p \leq 0.05$

H ₁₄ . Classify/categorize things into definable attributes.	1.734	0,164	Not supported
H ₁₅ . Communicate the results of what was observed in written and oral format.	2.658	0.051	Not supported
H ₁₆ . Apply given rules to reach a conclusion.	1.698	0.171	Not supported
H ₁₇ . Consult a variety of knowledge sources to gather information.	3.090	0.030	Supported $p \leq 0.05$
H ₁₈ . Identify similarities and differences among various elements.	3.498	0.018	Supported $p \leq 0.05$
H ₁₉ . Compare a problem with problems encountered before.	3.293	0.023	Supported $p \leq 0.05$
H ₁₁₀ . Understand the relationship of each component to the whole.	3.371	0.021	Supported $p \leq 0.05$
H ₁₁₁ . Make reasonable conclusions from observation or analysis of data.	2.404	0.071	Not supported
H ₁₁₂ . Identify and articulate errors in their own thinking or in that of others.	4.047	0.009	Supported $p \leq 0.05$
H ₁₁₃ . Explain the reasons for a conclusion.	2.735	0.046	Supported $p \leq 0.05$
H ₁₁₄ . Predict what will happen given the information you have.	8.198	0.000	Supported $p \leq 0.05$
H ₁₁₅ . Plan a way to test one's prediction.	4.650	0.004	Supported $p \leq 0.05$
H ₁₁₆ . Distinguish the most important elements of a problem.	4.553	0.005	Supported $p \leq 0.05$
H ₁₁₇ . Organize a conclusion about a problem in a logical fashion.	2.158	0.096	Not supported
H ₁₁₈ . Identify criteria for evaluating a problem solution.	2.752	0.045	Supported $p \leq 0.05$
H ₁₁₉ . Gather information or evidence to solve a problem.	3.737	0.013	Supported $p \leq 0.05$
H ₁₂₀ . Find corroborating evidence from among different data sources.	5.052	0.002	Supported $p \leq 0.05$
H ₁₂₁ . Determine the reliability of the evidence.	1.171	0.324	Not supported
H ₁₂₂ . Place an interpretation of a problem in the context of prevailing circumstances.	5.227	0.002	Supported $p \leq 0.05$
H ₁₂₃ . Generate a new ways of viewing a situation outside the boundaries of standard conventions.	7.444	0.000	Supported $p \leq 0.05$
H ₁₂₄ . Reformulate a problem to make it more manageable.	1.849	0.142	Not supported
H ₁₂₅ . Brainstorm new applications of content.	2.816	0.042	Supported $p \leq 0.05$
H ₁₂₆ . Anticipate potential problems.	3.316	0.022	Supported $p \leq 0.05$
H ₁₂₇ . Accurately summarize what is read or others have said, orally and in writing.	4.322	0.006	Supported $p \leq 0.05$
H ₁₂₈ . Ignore distractions that interfere with goal attainment.	0.351	0.788	Not supported
H ₁₂₉ . Make appropriate revisions on bases of feedback.	5.323	0.002	Supported $p \leq 0.05$
H ₁₃₀ . Assess risks involved in a solution.	2.026	0.114	Not supported
Table 3. Continued			
Sub-Hypotheses	F	Significance	Results
H ₁₃₁ . Monitor the outcome and revise a strategy where appropriate.	2.000	0.118	Not supported
H ₁₃₂ . Judge the credibility of evidence.	2.735	0.047	Supported $p \leq 0.05$
H ₁₃₃ . Evaluate the revise what is written.	1.914	0.131	Not supported
H ₁₃₄ . Ask questions to oneself about ideas he/she is unsure of.	1.483	0.222	Not supported
H ₁₃₅ . Catch fallacies and contradictions.	4.064	0.009	Supported $p \leq 0.05$

H ₁₃₆ . Meaningfully praise the performance of others.	0.536	0.658	Not supported
H ₁₃₇ . Share and take turns.	1.583	0.197	Not supported
H ₁₃₈ . Help keep others on- task.	3.667	0.014	Supported p≤0.05
H ₁₃₉ . Provide assistance to others when needed.	2.344	0.076	Not supported
H ₁₄₀ . Engage in tasks even when answers or solutions are not immediately apparent.	4.504	0.005	Supported p≤0.05
H ₁₄₁ . Seek accuracy.	3.957	0.010	Supported p≤0.05
H ₁₄₂ . Is flexible to change viewpoint to match the facts.	2.896	0.038	Supported p≤0.05
H ₁₄₃ . Demonstrate restraint over impulsive behaviors	0.845	0.472	Not supported
H ₁₄₄ . Compose drafts and tryouts in attempts to solve a problem.	1.073	0.383	Not supported
H ₁₄₅ . Demonstrate persistence in tackling difficult tasks.	3.101	0.029	Supported p≤0.05
H ₁₄₆ . Use a constructive tone when responding to others.	1.005	0.393	Not supported
H ₁₄₇ . Display enthusiasm for learning.	2.124	0.090	Not supported
H ₁₄₈ . Ask for feedback when needed.	2.708	0.048	Supported p≤0.05
H ₁₄₉ . Collaborate with others in team.	2.686	0.049	Supported p≤0.05
H ₁₅₀ . Provide assistance to others when asked.	4.588	0.004	Supported p≤0.05
H ₁₅₁ . Demonstrate independence in completing a project.	1.682	0.174	Not supported
H ₁₅₂ . Listen others attentively.	1.347	0.262	Not supported
H ₁₅₃ . Ignore distractions that interfere with goal attainment.	0.901	0.443	Not supported
H ₁₅₄ . Keep record on one's own progress toward important goals.	3.103	0.029	Supported p≤0.05
H ₁₅₅ . Realistically evaluate own performance.	1.198	0.313	Not supported
H ₁₅₆ . Set goals that achievable within a specific span of time.	3.326	0.022	Supported p≤0.05
H ₁₅₇ . Demonstrate awareness of ethical concerns and conflicts	2.829	0.041	Supported p≤0.05
H ₁₅₈ . Adhere to codes of conduct.	1.842	0.143	Not supported
H ₁₅₉ . Show an ability to resolve ethical dilemmas and conflicts.	2.218	0.089	Not supported
H ₁₆₀ . Maintain self-discipline in dealing with difficult situations.	3.617	0.015	Supported p≤0.05
H ₁₆₁ . Behave in a manner that communicates care and concern for others.	3.266	0.024	Supported p≤0.05
H ₁₆₂ . Act responsibly in dealing with tasks and people.	3.986	0.009	Supported p≤0.05

3.2.2. The Results of H₂

The ANOVA test results reveal that none of the subhypotheses is supported for H₂. That is why the tables of the test results are not separately included in this study. Instead, **Table 4** is used to evaluate the details.

The results for each term/group are as follows (based on **Table 4**):

Term 1: 46 students made totally 675 preferences. 140 (20.75 %) of these preferences favour Visual (V), 172 (25.48%) Aural (A), 156 (23.11%)

Reading/Writing (R), and 207 (30.66%) Kinesthetic (K)

Term 2: 24 students made totally 404 preferences. 67 (16.58%) of the preferences favor V, 111 (27.48%) A, 88 (21.78%) R, and 138 (34.16%) K.

Term 3: 27 students made totally 401 preferences. 72 (17.96%) of the preferences favor V, 105 (26.16%) A, 98 (24.44%) R, and 126 (31.42%) K.

Term 4: 31 students made totally 451 preferences. 84 (18.63%) of the preferences favor V, 98 (21.73%) A, 122 (27.05%) R, and 147 (32.59%) K.

Overall: 128 students made totally 1931 preferences. 363 (18.80%) of the preferences favor V, 486 (25.17%) A, 464 (24.03%) R, and 618 (32.00%) K.

The notes of significance to be highlighted are as follows.

- All four levels of the students are dominantly Kinesthetic learners. In other words, they prefer to put into the practice both their bodily and mental skills while

learning. The second dominating preference with almost all the participants seem to be Aural, which means they prefer to put into words the subject matters involved in learning. The least dominating preference in common is Visual.

- Almost half of the students have one preference and two thirds of them have two. One mode in the two preferences is, to a great extent, Kinesthetic

Table 4. The Results For The Test of Learning Preferences (VARK)

Terms	N	Total of preferences	V		A		R		K		One Preference	Two Preference	Three Preference	Four Preference
			Preferences	%	Preferences	%	Preferences	%	Preferences	%				
1	46	675	140	20.75	172	25.48	156	23.11	207	30.66	24	18	04	-
2	24	404	67	16.58	111	27.48	88	21.78	138	34.16	09	12	03	-
3	27	401	72	17.96	105	26.16	98	24.44	126	31.42	10	08	05	04
4	31	451	84	18.63	98	21.73	122	27.05	147	32.59	17	09	02	03
Overall	128	1931	363	18.80	486	25.17	464	24.03	618	32.00	60	47	14	07

- There exist almost no relation between the perceptions on the contributions of problem-based discussion sessions to cognition and metacognition and the dominating learning preferences.

CONCLUSION

Problem-based learning method is a means of active learning where learners are encouraged to get involved in and shoulder responsibilities for learning. It is a common view in the educational psychology that intrinsic motivation plays a crucial role in reaching the fruitful targets. Among the numerous factors affecting and sustaining intrinsic motivation are certain individual learning styles and preferences.

The purpose of this research is **two-fold**: finding out the extent to which problem-based discussion sessions promote cognition and metacognition as well as discovering the effects of the individual learning preferences on this promotion. The instrument of the research is a questionnaire consisting of two sets each of which is assumed to provide data for one of the above mentioned two-fold aims. For the former, "Higher Order Thinking and Problem Solving Checklist" (Borich, 2004: 294) and for the latter VARK (Fleming, 2001) was used.

Izmir Dokuz Eylul University, School of Maritime Business and Management, Department of Nutical Science, where problem-based learning method has been adopted for the last five years, was chosen as the field of the research. The problem-based discussion sessions, the core and the triggering part of the method, are believed to be affective in encouraging learners to get actively involved in the learning process and hence in acquiring higher order thinking skills. It is also assumed that individual learning preferences might affect the level of such acquisition.

An overall evaluation of the first part of the research reveals that the assumption of hypothesis 1 is proved true, i.e. there exist meaningful differences among the perceptions of the four different groups of learners. 38 out of 62 variables reflect meaningful differences. The distribution of this overall result through the subheadings is as follows: Application of Knowledge: 4 out of 7; Analytical Skills: 13 out of 14; Synthesis / Creativity: 4 out of 5; Evaluation / Metacognition: 3 out of 8; Disposition: 11 out of 21; and Values: 4 out of 6.

The data received for the second part of the research, H₂, assuming that the perceptions of

the learners differ in accordance with their individual learning preferences, however, do not prove the hypothesis set. With none of the variables, except “showing an ability to resolve ethical dilemmas and conflicts” only, there exist meaningful differences between the perceptions and the learning preferences. This overall result could be read as follows: Through the problem-based discussions, the individual learning preferences seem to have made no distinctive effects in the extent of acquiring certain cognitive and metacognitive domains. On the other hand, however, the data reveal that regardless of the differences in groups, the highest level of preference is accumulated in Kinesthetic, the second highest on Aural, the third on Reading/Writing and the fourth on Visual. When such overall finding is considered, the obvious rejection of H₂ would be understandable. Throughout the four terms (years), no significant change seems to have appeared in the learners’ learning preferences that are ranked, from most to the least dominant as follows: Kinesthetic, Aural, Reading/Writing and Visual. Another point to be considered while evaluating the data is that the field of the research is confined to only one of the several types of activities constituting the problem-based learning method. If the same research were conducted for any other part, say “presentation” or “professional skills”, a different picture could be drawn, particularly concerning the second hypothesis of the research.

The immediate benefit to be exploited by the education institution involved in this particular research is the clear order of the learning preferences from the most to the least dominant, listed as Kinesthetic, Aural, Reading/Writing and Visual. The medium of instruction in the relevant department could be rearranged in compliance with this order. In other words, the instructors in charge of presiding problem based discussion sessions should consider the prevailing individual learning preferences so as to make the sessions effective, efficient, and fruitful.

REFERENCES

1. Albanese.M (2000), Problem-based learning: Why curricula are likely to show little effects on knowledge and clinical skills, Blackwell Science Ltd. Medical Education 2000;34 pp:729-738
2. Albanese M. and Mitchell S. (1993), Problem-based learning – A review of Literature on It’s Outcomes and Implementation Issues, Academic Medicine 68:pp 52-81
3. Alverstein V. and Johannesen L:K: (2001), Problem-based learning approach in teaching lower level logistics and transportation, International Journal of Physical Distribution and Logistics Management, Vol 31 No 7/8 pp 557-573 MCB University Pres
4. Barrows H.S. and Tamblyn R.M. (1980). Problem-Based Learning. Springer, New York
5. Bellanca J. (1997) Active Learning - Handbook for the multiple Intelligences classroom, Sky Light Training and Publishing, Inc. Illionis, USA.
7. Borich, G.D. (2004), Effective Teaching Methods – Fifth Edition, Pearson Education, Inc., New Jersey 07458, USA.
8. Borkowski J.G. and Thorpe P.K. (1994), Self - Regulation and Motivation: A life Span Perspective on Underachievement, Self - Regulation of Learning and Performance Issues and Educational Applications; Edited by Dale H. Schunk and Barry J. Zimmerman, Lawrence Erlbaum Associates, Publishers Hillsdale, New Jersey 07642, USA.
9. Brown G. and Atkins M. (1994), Effective Teaching in Higher Education, British Library Cataloguing, Rutledge, London.
10. Burns, A.C. and Bush, R.F.(1995), Marketing research, Prentice Hall, Inc.New Jersey.
11. Dolmans D., Wolhagen I. and Van Der Vleuten C. (1998), Motivational and Cognitive Processes Influencing Tutorial Groups, Academic Medicine, Vol.73.no.10 / October Supplement
12. Dolmas D., Balendog H. Wolhagen I. and Vleuten C. (1997), Seven Principles of Effective Case Design for a Problem-Based Learning Curriculum, Medical Teacher, Vol.19 Issues 3
13. Evans L. and Abbott I. (1998), Teaching and Learning in Higher Education, Casell, Wellington House 125 Strand, London WCRR OBB

14. Fleming H. (2001), VARK A Guide to Learning Styles, <http://www.vark-learn.com/english/page.asp>.
15. Gilbert A. and FASTER S. (1996), Experiences with Problem-Based Learning in Business and Management, Thesis Pres, Amsterdam.
16. Kalkan M., Cerit A. G., Zorba Y. (2007), How PBL Sessions are used to promote cognitive, affective, and psychomotor domains: A case study at a maritime higher education and training institution, Teaching and Learning in the Maritime Environment Conference, CA, USA
17. Kaufman D.M. (2000), Problem-based learning- time to step back?, Blackwell Science Ltd., Medical Education 2000, vol.34,pp.504-511
18. Lourillard D. (1993), Rethinking University Teaching. A framework for the effective use of educational technology, Routledge, London.
19. Schmidt H.G. (1990), Educational Aspects of Problem-Based Learning: University of Linburg, The Netherlands.
20. Schmidt H.G. (1983), Problem-based learning : rationale and description, Medical Education, Vol.17, pp.11-16.
21. Salvin R.E.(1996), Research on Cooperative Learning and Achievement: What We Know, What We Need to Know, Contemporary Educational Psychology, Vol.21,pp.43-69.