

Educational Research and Reviews

Volume 10 Number 23 10 December, 2015

ISSN 1990-3839



ABOUT ERR

Educational Research and Reviews (ISSN 1990-3839) is published bi-monthly (one volume per year) by Academic Journals.

Educational Research and Reviews (ERR) is an open access journal that publishes high-quality solicited and unsolicited articles, in English, in all areas of education including education policies and management such as Educational experiences and mental health, the effect of land tenure system on resource management, Visualization skills and their incorporation into school curriculum, Gender, education and child labour etc. All articles published in ERR are peer-reviewed.

Contact Us

Editorial Office: err@academicjournals.org

Help Desk: helpdesk@academicjournals.org

Website: <http://www.academicjournals.org/journal/ERR>

Submit manuscript online <http://ms.academicjournals.me/>.

Editors

Dr. Peter W. Wong
Southern Cross University
Australia.

Associate Editors

Dr. Melissa Vick
School Of Education
James Cook University
Townsville,
Australia.

Dr. Maniam Kaliannan
Faculty of Administrative Science & Policy Studies
Universiti Teknologi MARA (UiTM)
Selangor,
Malaysia.

Dr. Tavis D. Jules
Cultural and Educational Policy Studies
School of Education
Loyola University Chicago
Chicago,
USA.

Dr. Adams Onuka
Centre for Peace and Conflict Studies (CEPACS)
University of Ibadan
Nigeria.

Dr. Yambo John M. Onyango
University of Eastern Africa
Kamagambo Adventist College Campus
Baraton,
Kenya.

Dr. Tolga Gök
Torbali Vocational School of Higher Education
Dokuz Eylül University
Izmir,
Turkey.

Assoc. Prof. Manjula Vithanapathirana
Faculty of Education
University of Colombo
Colombo,
Sri Lanka.

Dr. Ahmet Basal
Yıldız Technical University
Education Faculty
Foreign Languages Education Department
İstanbul,
Turkey.

Prof. Lazarus Ndiku Makewa
University of Eastern Africa
Baraton,
Kenya.

Prof. Ogunsakin R. Ebenezer
Department of Statistics
Ekiti State University
Ado Ekiti,
Nigeria.

Dr. A. Kadir Maskan
Dicle University
Ziya Gokalp Education Faculty
Department of Physics Education
Diyarbakir,
Turkey.

Dr. Mohd Akhtar Siddiqui
Institute of Advanced Studies in Education
Faculty of Education
Jamia Millia Islamia Central University
New Delhi,
India.

Editorial Board

Prof. García Mayo, María del Pilar

*Departamento de Filología Inglesa y Alemana y de Traducción e Interpretación
Universidad del País Vasco (UPV/EHU)
Paseo de la Universidad 5
Vitoria,
Spain.*

Prof. Frank Witlox

*Ghent University
Department of Geography
Gent,
Belgium.*

Prof. Georgios D. Sideridis

*University of Crete
Department of Psychology
Rethimno,
Greece.*

Prof. Andreas Veglis

*Department of Journalism and Mass Media
Aristotle University of Thessaloniki
Thessaloniki,
Greece.*

Prof. Mutendwahothe Walter Lumadi

*Curriculum & Instructional Studies
College of Education
UNISA,
South Africa.*

Dr. Miriam McMullan

*Faculty of Health and Social Work
University of Plymouth
Plymouth,
UK.*

Prof. Moshe Barak

*Graduate Program for Science and Technology Education
Ben-Gurion University of the Negev,
Beer Sheva,
Israel.*

Dr. Hiam Zein

*Psychology and Education
Lebanese American University
Chouran-Beirut,
Lebanon.*

Dr. Joel O. Eriba

*Faculty of Education
Benue State University
Makurdi,
Nigeria.*

Prof. Bingjun Yang

*School of Foreign Languages
Southwest University
Chongqing,
China.*

Dr. Ernest W. Brewer

*The University of Tennessee
Educational Administration and Supervision
Tennessee,
USA.*

Prof. Gail Derrick

*Regent University
School of Education
Virginia Beach,
USA.*

Dr. Evridiki Zachopoulou

*Department of Early Childhood Care and Education
Thessaloniki,
Greece.*

Dr. Francesco Pastore

*Seconda Università di Napoli
Italy,*

Dr. Syed Iftikhar Hussain Shah

*Technical Education and Vocation
TEVTA Secretariat
Lahore,
Pakistan.*

Dr. Ravi Kant

*College of Teacher Education
Maulana Azad National Urdu University
Darbhanga,
India.*

Dr. Dibakar Sarangi

*Directorate of Teacher Education and State Council for
Educational Research and Training
(DTE & SCERT)
Odisha,
India.*

Dr. Elisa Backer

*Faculty of Business
Federation University Australia
Australia.*

Dr. Ahmad Alkhaldeh

*Department of Curriculum and instruction
University of Jordan
Jordan.*

ARTICLES

Research Articles

- Effects of intra-family parameters: Educative style and academic knowledge of parents and their economic conditions on teenagers' personality and behavior** 2887
Mohammad Bakhtavar and Rana Bayova
- Determining science student teachers' cognitive structure on the concept of "food chain"** 2897
Derya Çınar

Full Length Research Paper

Effects of intra-family parameters: Educative style and academic knowledge of parents and their economic conditions on teenagers' personality and behavior

Mohammad Bakhtavar* and Rana Bayova

Social Psychology, BDU University in the Republic of Azerbaijan, Tabriz, Iran.

Received 15 June, 2015; Accepted 13 November, 2015

The present study aims to investigate the effects of intra-family parameters; educative styles and academic knowledge of parents and their economic condition on teenagers' personality and behavior. The present study is a descriptive survey. The statistical sample of the study included 166 teenage students from Baku, Azerbaijan and 332 of their parents were selected through stratified random sampling based on the size of the population. The data were collected through Eysenck personality questionnaire specifically designed for adolescents and adults along with Baumrind parental authority questionnaire. Results from data analysis revealed that there is a significant relationship between educative styles of parents and adolescent personality types, that is, teenagers' personality types differ according to their parents' parenting styles. Parents with logical parenting styles tend to have children with more extrovert personalities. The relationship between fathers' educational level and educational models of parents is also significant. And, the relationship between mothers' educational level and educational models of parents is significant as well. The study failed to find a significant relationship between personality types in adolescents and their residence; however, the relationship between their personality types and economic status of the family is significant. Since findings of the present study approve the relationship between parenting styles of parents and personality types of adolescents, it is strongly suggested that parents be taught the outcomes of strict and easy going parenting through educational programs.

Key words: Parenting style, authoritative, authoritarian, personality types.

INTRODUCTION

Family and its structure play a critical role in the formation of mental health in its members and specifically the children (Henrich et al., 2012). Dynamic organizational personality is among all the internal and mental processes facilitating adaptability of human to his

environment (Schultz translated by Sayid-Mohammadi, 2006: 45). Family is the primary effective context for personality to be created and to grow (Grusec, 2002; Smetana, 2011; Steinberg and Silk, 2002; Grusec and Davidov, 2007). In the triplet organization of culture,

*Corresponding author. E-mail: m.bakhtavar@yahoo.com.

parents and children, parents act as a bridge covering the gap between cultural beliefs and assumptions existing in children's daily life. It is generally accepted that only two types of information are to be transferred to the future generations: the genetic data and the cultural information both of which could be transmitted through parents (Bornstein, 2006). According to two major approaches, the interaction between parents and children affects socialization of children. In the first one, typology is used to investigate parenting styles and the second one applies social interaction approach to study the internal interactions between a parent and the child (Park and Buriel, 2006).

Families take different approaches in educating their children. Parenting methods include all relatively stable methods and models parents have in their relationship with other members of the family and provide the ground for mutual interactions (Stevenson and Akister, 2008).

In spite of the roles family has in the formation of behaviors in children, studies have shown that family problems are the most important pathological causes for mental disorders in children. Parenting styles of parents, their mental disorders, courtship problems, and other stressful conditions in a family are all among culprits (Madrigal, 2007). On the other hand, children's personality traits including his disorders affect families and parents (McCartney and Philips, 2006).

Several statistical studies have shown that the major causes of children visiting mental health specialists are behavioral disorders. Inefficient parenting styles, unsupportive behavior, poor supervision, and antisocial behavior from parents are among the most critical prognosticating factors of behavioral disorders in children (Cord, 2004).

Accordingly, the present study attempts to consider theoretical frameworks of personality types and educational models along with economic and social factors in the family environment and investigate the relationship between parenting methods applied by parents in Baku and personality types authoritative adolescents. Moreover, the study aims to probe the relationship between authoritative personality types in adolescents and their parents' levels of academic knowledge and economic status.

THEORETICAL FRAMEWORK

Personality has been investigated from various points of view. The nature of growth, health, disorders and personality types are some of these perspectives. Several theories have been proposed by scholars on different personalities and based on these theories, various gauging devices have been suggested (Siasi cited in Sadeghian and Sheikh, 2011).

The concept of personality type indebted its existence to the works of prominent Swiss psychologist Carl Jung and

two American women named Catherine Briggs and her daughter, Isabel Briggs. Jung as a psychoanalyst following Sigmund Freud concluded that behaviors seemingly unpredictable could be understood and identified provided that the bases for mentalities and approaches of individuals are recognized. While Jung was working on his discoveries, Catherine Briggs, astonished by similarities and differences between human personalities, devised a special system for determining personality types (Tiger and Tiger, 2004).

Psychologists have studied personalities from different perspectives. Some like Gordon Allport and Raymond Cattell have focused on traits and scholars like Freud have investigated them according to psychoanalysis principles. Others like Krechmer and William Sheldon have concentrated on biological aspects; yet, humanistic aspects were investigated by psychologists like Abraham Maslow and Carl Rodgers along with social aspects are studied by scholars like Eric Erikson. In the 1960s and 1970s, as will be discussed later in this paper, Meyer Friedman and Ray Rosenman proposed Personality types A and B (Khenifer et al., 2008).

Humanistic approach with theorists like Abraham Maslow and Carl Rogers focus on self and its powers are humanistic forces leading humans to self-actualization. In this regard, human values and interests are the first priorities. This approach dates back to over 2000 years ago. Allport, Cattell and Eysenck believe that personality traits are affected by heredity and recent studies have proven the biological basis for main personality traits. In the 1980s, various models were introduced based on trait approach and factor analysis to determine personality structure. Robert McCrea and Paul Costa advanced the famous five major domains of Openness to experience, Conscientiousness, Extraversion, Agreeableness, Neuroticism in personality and tried to prove the convergence of different approaches around this theory. Strong evidences suggest that traits like neuroticism, psychopathicism and introversion are hereditary traits according to Eysenck. Personality theorists like Adler, Hurnay, Frum, Maslow, Rogers and even Allport and Cattell believe that the social environment we are living in affects personality. Erikson stated that social and historical and social factors influence the formation of personality (Schultz et al., 2003: 555).

Typology offered by Baumrind is the most common plan for outlining parenting styles. According to his typology, parenting is conducted on two basic dimensions: demandingness and warmth. Combinations of these two dimensions including high criteria, obligations of maturity, perfection and control for demandingness and compassion, reception, support and sensitivity of parents for warmth present four major parenting styles. Baumrind, in the first stage of his study, focused on three authoritative, authoritarian and indulgent styles. In his later work with Macobi and Martin (1983), derived the negligent style from the indulgent one

and as a result, the fourth group of negligent parents were added to the first three styles (cited in Smetana, 2011). Various studies conducted on these three styles have revealed that they have the potential to increase negative and positive outcomes in children (Olsen et al., cited in Diaz, 2011).

In the present study, theoretical framework will be presented along with a review over studies conducted in the field and experts' views toward the relationship between parenting styles and personality types. It is a fact that several studies have been conducted on the role of parents and their parenting style on personality growth and behavioral disorders of the children; however, not many studies have focused their attention on the relationship between parenting styles and personality types. This proves the significance this study has.

Background

Davari-Fard and Mami (2015) compared personality traits and parenting styles of mothers of female primary school students suffering externalized disorders with mothers of normal students and concluded that the difference between personality traits and parenting styles of mothers of normal students and mothers of children with externalized disorders is not significant. In other words, personality traits and parenting styles of mothers of normal children and mothers of students with externalized disorders are similar. Personality traits and parenting styles of mothers are important factors for children suffering from externalized disorders. Therefore, this study suggested that both parents of boys and girls be compared and investigated.

Ekhtiari (2009) concluded that there is a significant relationship between authoritarian and indulgent parenting styles and externalized behavioral disorders; yet, the relationship between authoritative parenting style and externalized behavioral disorders was not significant. Rahmani et al. (2006: 182) conducted a study titled "the relationship between parenting styles and behavioral problems of adolescent students of Tabriz" (2003) on 360 students of public schools in Tabriz samples selected through cluster sampling. It is reported that their parents had an authoritative style and the students had mild behavioral problems (39.7 and 39.2% respectively). The relationship between parenting style and behavioral problems was significant.

Sohrabi and Hassani (2006: 221) investigated the effects of parenting styles of parents on social behaviors of adolescent girls in Tehran and revealed that authoritarian style of parenting significantly affected disruption in family, drug abuse and antisocial behavior in teenage girls. However, parents' age and number of their children do not have a significant effect on their antisocial behavior. This study suggested that authoritative (democratic) style is the recommended style for

preventing antisocial behavior in teenagers.

According to studies conducted by Kaming (2005), children's continuous exposure to family quarrels and conflicts induce externalization behaviors. Researchers believe that stress and internalized behavior cause introversion and anxiety in girls and make boys demonstrate aggression or disobedience (Chronis et al. 2011).

Another study on parenting styles revealed that authoritative, authoritarian and indulgent parenting styles can increase or decrease positive or negative outcomes in children (Olsen, 2001 cited in Diaz, 2011).

A study on primary school children revealed that children with behavioral disorders had mothers with high aggression and depression levels, received little or no social support and used parenting styles of negligence or punishment (Gimpel and Holland, 2011).

Winslow et al. (2005) demonstrated that the relationship between authoritarian parenting style and externalized behavior in boys is significant.

Furnham and Chang (2000) said authoritative parenting style affects self esteem in individuals. Deci and et al. (2001) conducted a study and concluded that basic psychological needs have a significantly positive effect on self esteem and negative effect on anxiety.

Karavasilis et al. (2003) found a positive and significant relationship between authoritative parenting style and safe attachment; however, indulgent parenting induced avoidant attachment.

Chen and Goldsmith (1991) and Clopper et al. (1981) investigated single-child families and found that indulgent parenting is more popular with them giving the child more freedom to act and less punishment experience (cited in Hussainian et al., 1996: 135). Psychology has shed light on the interesting point that children from authoritative and securing families have the greatest effects on their parents (Lewis, 1982).

In the present study, the relationship between parenting styles and personality types is investigated in teenagers in Baku. This study probes the effects of interfamily factors like indulgent, strict and democratic parenting styles on adolescents' personality types, their parents' personality types and parents' level of education along with the relationship between adolescents' personality types and their residence and their parents' professional, economic and social status.

Research hypotheses

- 1) There is a relationship between parenting styles of parents and personality types of adolescents.
- 2) There is a relationship between parenting styles of parents and fathers' level of education.
- 3) There is a relationship between parenting styles of parents and mothers' level of education.
- 4) There is a relationship between adolescents'

personality types and their residence.

5) There is a relationship between adolescents' personality types and their families' level of income.

METHODOLOGY

Since this study aims to investigate the relationship between indulgent, authoritative, authoritarian and democratic parenting styles with personality types of adolescents, it is an applied research from the point of view of purpose. It also is a descriptive survey study of a correlation nature.

Statistical population of the study included all boys and girls aged 15 to 18 studying in public high schools of Baku. This population included 2160 students and 1064 of their parents. The statistical sample of the study included 166 subjects selected through cluster sampling. This sample answered the 80-question Eysenck questionnaire on personality types. Their parents were asked to answer parenting styles 48-question Eysenck short form (adults) personality test. Parents included 332 subjects. According to Morgan table and based on the population of Baku, 80 of the students were boys and the remaining 86 were girls. The parents of these 166 students formed the 332 parents' group. The data for the study were collected using three tools.

Parenting styles questionnaire

This adaptation tool is based on Baumrind theory on indulgent, authoritative and authoritarian parenting styles. This questionnaire included 30 articles on the most indulgent, 10 articles on authoritative and the other 10 articles on authoritarian parenting styles. In this test, fathers and mothers expressed their ideas individually by checking a scale ranging from zero as completely disagree to four as completely agree. Adding up the scores gives three separate scores on the most indulgent, authoritative and authoritarian parenting styles for each subject (Sina Institute on Behavioral Studies, Ravan Taj-hiz):

- 1) 10 expressions related to indulgence scale: 1- 6- 10- 13- 14- 17- 19- 21- 24- 28
- 2) 10 expressions related to authoritarianism scale: 2- 3- 7- 9- 12- 16- 18- 25- 26- 29
- 3) 10 expressions related to authoritarianism scale: 4- 5- 8- 11- 15- 20- 22- 23- 27- 30

Reliability and validity

In the present study, the validity of the data collection tool was determined by content validity and specifically face validity. In this regard, the validity of the questionnaires was reviewed and evaluated by five prominent professors of state universities in Tabriz who were expert in educational sciences, psychology and social sciences. The questionnaires were used only after they were approved by experts. The questionnaire was already used in studies by Esfandiari (1995) and Beinem (2000). Esfandiari calculated its reliability to be 0.69 for indulgence, 0.77 for authoritarianism and 0.73 for authoritarianism. Retest method calculated the reliability for indulgence to be 0.81, authoritarianism to be 0.85 and authoritarianism of fathers to be 0.92 (Baur, 1991). He reached the following results for the validity of the questionnaire: there is a reverse relationship between authoritarianism of father with indulgence (0.50) and his authoritative (0.52). The study

also found α -Cronbach coefficient of the questionnaire to be 0.85. Since the standard level of this coefficient is 0.7, the questions are of good reliability. The α -Cronbach coefficient of reliability of the parenting style questionnaire in relation to authoritarianism was calculated to be 0.75. Since the standard level of reliability is 0.7, the questions of this questionnaire had good reliability. The α -Cronbach reliability coefficient of the questions concerning authoritative was 0.72, which is a good reliability since the standard level is 0.7.

Short version 48-question Eysenck questionnaire of personality test for adults to which parents of the students responded

The first test made by Eysenck in 1953 was the Maudsley questionnaire (MMQ). Later on, Maudsley questionnaire on personality (MPI) had 48 questions (Eysenck, 1959). The next Eysenck questionnaire (EPI) had 57 questions (Eysenck and Eysenck, 1964). Eysenck personality questionnaire (EPQ) included 90 questions and finally the revised Eysenck personality questionnaire (EPQ-R) had 100 questions (Eysenck et al., 1975). Due to the length of the questionnaires and tiredness of the subjects, Eysenck and his colleagues decided to provide a shorter version of the same questionnaire. The present study uses this revised version (EPQ-R) for adults. This questionnaire included four scales of neuroticism, psychoticism, extroversion, introversion and lies detecting with 12 questions for each scale. In this test, the validity of questions for men and women was 0.84 and 0.80 respectively. For neuroticism, the validity was 0.88 and 0.84. Validity of the questions on extroversion was 0.62 and 0.61 and finally the validity of the questions for lie detecting scale was 0.77 and 0.73.

Reliability and validity

In the present study, the validity of the data collection tool was determined by content validity and specifically face validity. In this regard, the validity of the questionnaires was reviewed and evaluated by five prominent professors of state universities in Tabriz who were expert in educational sciences, psychology and social sciences. The questionnaires were used only after they were approved by experts. According to the findings from the present study, it could be concluded that reliability coefficient of Eysenck questionnaire for adults and for the scales of psychoticism, neuroticism, extroversion and lie detection was 0.717 based on α -Cronbach table and since the standard level is 0.7, the questions of the questionnaire are of good reliability. The α -Cronbach coefficient was 0.718 for psychoticism scale and since the standard level is 0.7, the questions concerning that scale are of good reliability. The α -Cronbach coefficient was 0.71 for neuroticism scale and since the standard level is 0.7, the questions concerning that scale are of good reliability. Finally, the α -Cronbach coefficient was 0.72 for extroversion scale and since the standard level is 0.7, the questions concerning that scale are of good reliability.

Eysenck personality test for adolescents

Eysenck (1974) conducted an expansive study on personality using symptoms introduced by psychologists treating 700 neurotic soldiers. Some of these signs were external data including age, job and family status and others were clearly identified mental ones. Two of the factors including neuroticism and extroversion-introversion were the focus of attention by Eysenck. According to Eysenck, these two factors are sufficient for basic clarification of

personality (Lee, 1994: 84). These two dimensions are in concordance with Hippocrates' quartet natures. Eysenck adds a third dimension to these two major ones and named it psychotic. Eysenck and Lang (1986) (cited in Parvin, 1995: 15) believe that they have found numerous evidence on the existence of these dimensions. This evidence may at the same time prove the hereditary nature of these dimensions. In 1963, Eysenck and his wife did some modifications on Maudsley Personality Index and created a new questionnaire with 48 topics half of which focused on extroversion, introversion and neuroticism. Results from this study revealed that personality is of three limits each with an opposite side:

- 1) Introversion and extroversion
- 2) Neuroticism and lack of neuroticism
- 3) Psychotic and non-psychotic

The Iranian norm Eysenck personality test for adolescents has 80 yes-no questions with no true false or misleading item. Content validity of a test is usually determined by experts in the field and depends greatly on referees' views (Bazargan et al., 2000; Tabatabayi, 1995; Sarookhani, 1998). In order to evaluate the reliability of the questions factor analysis and α -Cronbach model were applied. Results revealed that reliability coefficient of Eysenck questionnaire for adults were 0.812 in case of introversion and extroversion, neuroticism and lack of neuroticism, psychotic and non-psychotic scales. Since the standard level for reliability is 0.7, the questions in this questionnaire are of good reliability.

Research plan and data analysis models

Data in this study were analyzed using SPSS 15 computer application. In order to predict parenting styles using parents' education, job, age, social status, economic status, gender, and residence, the Wilks's lambda distribution test was conducted. Fathers' authoritarianism was determined through step by step multiple regression test and using parameters of gender, age, education and social status.

RESEARCH FINDINGS

51.8% of students in Baku were girls and the remaining 48.2 % were boys. 10.2% of fathers under study were illiterate, 42.8% had finished primary school education, 30.7% had finished high school and the remaining 16.3% held university degrees. 28.9% of mothers were illiterate. 45.2% of women had finished primary school education, 22.3% had high school diploma and the remaining 3.6% of women held university degrees. 24.7% of families were low-income, 48.8% had average income and 26.5% had a high income. 16.3% of the families under study were living in rental houses and the remaining 83.7% had their own houses. 10.5% of families had indulgent parenting style, 23.3% were authoritarian and 66.3% were authoritative in their parenting style. In case of boys, 11.3% of the families were indulgent, 25% were authoritative and 63.8% were authoritative. In case of boys and girls, 10.8% of families were indulgent, 24.1% were authoritarian and the remaining 65.1 were authoritative in their parenting style. 50% of girls were extroverts, 18.6% were neurotics and 31.4% were lie

detectors. Yet, 23.8% boys were extrovert, 16.3% were neurotic, 10% were psychotic and the remaining 50% were lie detectors. The dominant personality type in boys was lie detectors and girls were dominantly extroverts. 17.5% of all adolescents under study were neurotic, 37.3% were extroverts, 4.8% were psychotic and 40.4% were lie detectors. The face in this distribution is for the adolescents with extrovert personality types. On the other hand, 6.6% of parents were lie detectors, 46.6% were psychotic, 20.5% were extroverts and 26.5% were neurotic.

Hypothesis 1: There is a relationship between parenting styles of parents and personality types of adolescents.

According to the data in Table 1, it can be concluded that the relationship between parenting styles and personality types in adolescents is significant with X^2 of 13.02 with the level of significance of 0.04. The severity of the relationship according to Cramer V coefficient was 0.198. Therefore it could be said that adolescents' personality types differ according to their parents' parenting style and parents with more indulgent parenting style have extrovert children.

Hypothesis 2: There is a relationship between parenting styles of parents and fathers' level of education.

According to the data in Table 2, it can be concluded that the relationship between parenting styles and dominant personality types in adolescents is significant with X^2 of 16.99 with the level of significance of 0.009. The severity of the relationship according to Cramer V coefficient was 0.226 with the level of significance of 0.009. Therefore, it could be concluded that there is a significant relationship between fathers' level of education and their parenting style.

Hypothesis 3: There is a relationship between parenting styles of parents and mothers' level of education.

According to the data in Table 3, it can be concluded that the relationship between parenting styles and dominant personality types in adolescents is significant with X^2 of 16.85 with the level of significance of 0.01. The severity of the relationship according to Cramer V coefficient was 0.225 with the level of significance of 0.01. Therefore, it could be concluded that there is a significant relationship between mother' level of education and their parenting style.

Hypothesis 4: There is a relationship between adolescents' personality types and their residence.

According to the data in Table 4, it can be concluded that the relationship between place of residence and personality types in adolescents is not significant with X^2 of 1.63 with the level of significance of 0.652. Therefore,

Table 1. The relationship between parents' parenting style and adolescents' personality types (Baku).

Parenting style		Fathers' level of education				Total	Significance
		Illiterate	Primary school	High school	University degrees		
Neuroticism	Frequency	1	12	16	29	X ² = 13.02	
	Percentage	5.6	30	14.8	17.5		
Extroversion	Frequency	8	8	46	62	Cramer V= 0.198	
	Percentage	44.4	20	42.6	37.3		
Psychotism	Frequency	1	4	3	8	Level of significance= 0.04	
	Percentage	5.6	10	2.8	4.8		
Lie detecting	Frequency	8	16	43	67	Level of significance= 0.04	
	Percentage	44.4	40	39.8	40.4		
Total	Frequency	18	40	108	166		
	Percentage	100	100	100	100		

Table 2. The relationship between fathers' education and their parenting style (Baku).

Parenting style		Mothers' level of education				Total	X ² = 16.99
		Illiterate	Primary school	High school	University degrees		
Indulgent	Frequency	5	7	4	2	18	Level of significance= 0.009
	Percentage	29.4	9.9	7.8	7.4	10.8	
Authoritarian	Frequency	5	11	12	12	40	Cramer V= 0.226
	Percentage	29.4	15.5	23.5	44.4	24.1	
Logical	Frequency	7	53	35	13	108	Level of significance= 0.009
	Percentage	41.2	74.6	68.6	48.1	65.1	
Total	Frequency	17	71	51	27	166	Level of significance= 0.009
	Percentage	100	100	100	100	100	

Table 3. The relationship between mothers' education and their parenting style (Baku).

Parenting style		Mothers' level of education				Total	X ² = 16.854
		Illiterate	Primary school	High school	University degrees		
Indulgent	Frequency	10	7	1	0	18	Level of significance= 0.001
	Percentage	20.8	9.3	2.7	0	10.8	
Authoritarian	Frequency	13	11	13	3	40	Cramer V= 0.225
	Percentage	27.1	14.7	35.1	50	24.1	
Logical	Frequency	25	57	23	3	108	Level of significance= 0.01
	Percentage	52.1	76	62.2	50	65.1	
Total	Frequency	48	75	37	6	166	Level of significance= 0.01
	Percentage	100	100	100	100	100	

Table 4. The relationship between adolescents' place of residence and their personality type.

Personality type		Families' residence			X ² = 1.631
		Rental	Proprietorship	Total	
Neuroticism	Frequency	7	22	29	Level of significance= 0.652
	Percentage	25.9	15.8	17.5	
Extroversion	Frequency	9	53	62	
	Percentage	37.3	38.1	37.3	
Psychotism	Frequency	1	7	8	
	Percentage	3.7	5	4.8	
Lie detection	Frequency	10	57	67	
	Percentage	37	41	40.4	
Total	Frequency	27	139	166	
	Percentage	100	100	100	

Table 5. The relationship between family income and adolescents' personality types.

Personality type		Income			Total	X ² =71.352		
		Low	Average	High				
Neuroticism	Frequency	12	15	2	29	Level of significance= 0.000		
	Percentage	29.3	18.5	4.5	17.5			
Extroversion	Frequency	3	22	37	62			
	Percentage	7.3	27.2	84.1	37.3			
Psychotism	Frequency	3	1	4	8		Cramer V= 0.464	
	Percentage	7.3	1.2	9.1	4.8			
Lie detection	Frequency	23	43	1	67			
	Percentage	56.1	53.1	2.3	40.4			
Total	Frequency	41	81	44	166			Level of significance= 0.000
	Percentage	100	100	100	100			

it could be concluded that there is no significant relationship between place of residence and their parenting personality type.

Hypothesis 5: There is a relationship between adolescents' personality types and their families' level of income.

According to the data in Table 5, it can be concluded that the relationship between family income and personality types in adolescents is significant with X² of 71.35 with the level of significance of 0.000. The severity of the relationship is above average according to Cramer V coefficient was 0.464 with the level of significance of 0.000. Therefore, it could be concluded that there is a

significant relationship between family income and their adolescents' personality type. Families with low incomes have more of neurotic personalities; families with average income have more of lie detecting personalities and families with high levels of income are generally extroverts.

DISCUSSION

The present study aimed to investigate the relationship between parenting styles of parents and personality types in adolescents considering environmental components. Results on the first hypothesis revealed that the relationship between parental styles and adolescents'

personality types is significant with X^2 of 13.02 with the level of significance of 0.04. Therefore, it could be concluded that adolescents' personality types differ according to their parents' parental styles, that is, parents with more authoritative parenting style have more extrovert children.

The results from this study agree with findings from a study conducted by Fakhri (1996) who reported that unlike authoritarian families, authoritative and democratic families in Iran have more social children. Besides, the results also confirm Jazayeri (2004) who concluded that the relationship between democratic parenting style and personality growth in adolescents is significant. They also agree with findings from Rahmani et.al. (2006) who found that the highest percentage of students and adolescents in Tabriz has reported an authoritative or democratic parenting style for their parents.

Schultz et al. (2002: 549-559) reported that violent and punishing parents may suppress extroversion, openness, complacency and sociability as main characteristics of sociable and extrovert individuals. On the other hand, the present study concluded that psychotic parents take authoritarian parenting style and this concurs with findings of Baldwin (1945) who reported that authoritarian, and rejecting parents have rebellious, aggressive and unstable children (cited in Pervin, 1993). These results also confirm findings of Karen Hornay (cited in Pervin et al., 1999: 175) concluding that interpersonal relationships are the axis for healthy or unhealthy behavior in individuals. In Iran, the findings of this study agree with findings of Taghavi and Kalantari (2006) who reported that adolescents with authoritarian parents are more depressed compared to adolescents with democratic parents. The results also agree with findings of Oliver et.al. (2009), Komsil et al. (2008), Olson et.al. (2005), Usher cited in Zankman and Bonomo (2004) and Leiyin et al. (2011). They demonstrated that emotional stability, parental styles leading to loyalty and parents' personality type are the factors predicting personality traits, behaviors and psychological actions of adolescents.

Results on the second hypothesis revealed that the relationship between parenting styles and fathers' level of education is significant with X^2 of 16.99 with the level of significance of 0.009. Therefore, it could be concluded that there is a significant relationship between parenting styles and fathers' level of education. Moreover, results on the third hypothesis revealed that the relationship between parenting styles and mothers' level of education is significant with X^2 of 16.85 with the level of significance of 0.01 and the severity of relationship with Cramer V coefficient of 0.225 and the level of significance of 0.01. Therefore, it could be concluded that there is a significant relationship between parenting styles and mothers' level of education.

Thus, it can be concluded that the relationship between parenting style and fathers' level of education is

significant. Fathers with higher levels of education had a more logical view toward parenting compared to illiterate fathers or the ones with primary school education who were more authoritarian in their parenting style. These findings agree with findings of Shokraneh (2006) who reported less pressure from parents with several children on their children and have more democratic view toward parenting them. These findings also confirm the findings of Jarami (1986), Poor (2001), Salehin and Zadeh (2003) who reported a significant relationship between parenting styles and parents' level of education. In other words, the higher the level of education, the more democratic parenting styles are applied and as the level come down, authoritarian styles are become more popular. The relationship between parenting styles and mothers' level of education in Baku is also significant with X^2 of 16.58 and the level of significance of 0.01.

As it was discussed earlier, parenting styles and parents' level of education are significantly related. Nevertheless, since reaching higher levels of education does not necessarily end in better jobs or higher incomes and some individuals have no proper job in spite of their high level of education along with illiterate people with highly paying jobs, attending higher education institutes does not imply higher self-confidence and social status to have a motivated lifestyle with little problem with life's ups and downs. All of these may end in high resistance power, better adaptability against crises of life and more logical and constructive parenting styles. In order to further elaborate on the significance of education on post-divorce life, Sarookhani (1997) states that as the level of education goes higher, the sensitivity toward issues increases and literacy acts as an informative factor inducing sympathy to other people and understanding of their problems. Besides, it could be said that as the level of education increases, individuals feel more responsible to act according to their social status and avoid improper acts (Sarookhani, 1997: 11).

Results on the fourth hypothesis revealed that the relationship between place of residence and adolescents' personality type is not significant with X^2 of 1.63 with the level of significance of 0.652. Therefore, it could be concluded that there is no significant relationship between place of residence and adolescents' personality type. Moreover, results on the fifth hypothesis revealed that the relationship between family income and adolescents' personality types is significant with X^2 of 71.35 with the level of significance of 0.000. Therefore, it could be concluded that there is a significant relationship between family income and adolescents' personality type, that is, families with lower incomes have more neurotic adolescents, families with average income levels have more lie detecting adolescents and families with high levels of income have more extrovert children.

In this regard, it could be said that financial welfare and better job opportunities help individual overcome their problems efficiently and manage all the expenses like

rents, childcare, education costs and health care in a better way compared to those with lower incomes and weaker financial welfare. Better financial condition leads to a better ground for improving personality traits. In low-income families, the main concern of family is supplying daily needs and this puts extra pressure on family and children ending in neglecting social and psychological life of children. Families with low income may have a warm environment at home; yet stress is prevalent in these families and this affects parenting styles and personality types of children. Another important point worth mentioning on the significant relationship between family income and personality types in adolescents is that higher income reduces concern over petty needs (according to Maslow) and the concerns of family move to growth and improvement of life. However, if families worry about providing themselves with basic needs of life, their interactions will be seriously affected and the possibility for an unpleasant life increases.

Parenting as a family duty plays vital roles in guiding children's behavior (Kann and Hanna, 2008). As it was expected, results revealed that authoritative parenting style has significant relationship with reducing extroversion problems. This finding agrees with findings from studies by Berahman (2002), Hammen (2003) and Ekhtiari (2009). Results also revealed that authoritarian and indulgent parenting styles have relationship with increased extroversion problems. This finding confirms the results reached by Venezilo et al. (2005), Hart (2001), Ekhtiari (2009) and Moosavi (2008).

Conclusion

The study therefore revealed that families with more democratic and cooperative parenting styles have the higher possibility for adaptation with condition and provision of a better environment for their children. These parents supervise their children and limit them with logical requests. Besides, these parents use passionate behaviors like hugging and kissing of their kids. They take very moderate behavior in parenting their children and while expecting obedience from their child; take his or her ideas into account by taking logical measures against them. Good levels of responsibility, intimacy, control and limitation are the elements used by authoritative parents. These behaviors reduce the possibility of behavioral disorders in children. In case of authoritarian parenting style, caring and relationship decreases and the structure turns into an improper one. This structure provides an indecent ground for child growth and induces behaviors with negative labels. These parents wish everything they say to be accepted by their children and this reduces the relationships in the family. These parents use severe punishments to control their children's behavior and this causes behavioral disorders in higher levels. In indulgent parenting style, the

lowest level of caring and structure is experienced. These families tend to give more encouragement, passion and freedom of action along with appropriate levels of physical and mental expectations from their children. Children grown up in this way, lack self-confidence and cannot control their wishes and desires. Lack of supervision from their parents and parents' negligence toward child and their behavior may induce extrovert behavioral disorders in the child for they have not learned the necessary life skill.

Suggestions and applications of the results

- 1) Considering the results from this study it seems as if authoritative and trust-giving parenting (democratic) styles are proper styles of parenting children. Teaching parenting styles by teachers, media and universities are apparently necessary.
- 2) Special classes for parents in parent-teacher meeting must be held in order to let parents get familiar with proper parenting styles by experts and specialists in proper times and occasions. This will help parents consider the ages and conditions of their adolescents and follow decent parenting styles in their homes.
- 3) Considering the role of family in the evolution of personality in children and adolescents, it is suggested that various TV and Radio programs be made using expert views and with the help of university professors, psychologists, sociologists and all those whose ideas may be of any help.
- 4) Booklets and brochures with the suggested titles of "proper personality of children", "parenting styles" and "how to behave our children?" must be prepared by authorities and experts in related fields and be given to parents to be used in parenting their children.
- 5) Considering the relationship between parenting styles and mothers and fathers' level of education, it is suggested that parents and especially younger ones continue their education to university levels and higher education by education authorities.
- 6) In the present study, the focus was on 15 to 18 year olds; it is suggested that further studies concentrate on sibling roles, their order of birth in the family, and the number of children in the family be investigated in children and adolescents of primary and secondary schools by researchers in the field of personality and family studies.

Conflict of interests

The authors have not declared any conflict of interest.

REFERENCES

- Chronis AM, Gamble SA, Roberts TE, Pelham WE (2011). Cognitive behavioral depression treatment for mothers of children with ADHD. Manuscript in preparation.

- Davari-Fard, F, Mami S (2015). Comparison on personality traits and parenting styles of Mothers of Primary School Girls with Extroverted Disorders and Mothers of Normal girls of Ilam. *J. Med. Sci. Ilam Univ.* 91:149-158.
- Deci EL, Ryan RM, Gagne M, Leone DR, Usunov J, Kornazheva BP (2001). Need satisfaction, motivation, and well-being in the work organizations of a former eastern bloc country: A cross-cultural study of self-determination. *Soc. Pers. Soc. Psychol.* 27(8):930-42.
- Diaz Y (2011). Association between parenting and child behavior problems among Latino mothers and children. Unpublished Master Thesis, University of Maryland.
- Fakhri A (1996). A Study on the Effects of Methods of Socializing Parents on Socialization of Children. Thesis Submitted to Receive Masters Degree. Tehran: Faculty of Social Science, Allame Tabatabayi University.
- Furnham A, Cheng H (2000). Perceived parental behavior, self-esteem, and happiness. *Soc. Psycho. Psychiatr. Epidemiol.* 35:463-70. [Persian]
- Gimpel GA, Holland ML (2011). Emotional and behavioral problems of externalizing and internalizing early childhood. *J. Abnorm. Child Psychol.* 32(4):595-607.
- Grusec JE (2002). Parental socialization and children's acquisition of values. In M. H. Bornstein (Ed.), *Handbook of parenting, Vol. 5: Practical issues in parenting* (pp. 143-168). Mahwah, NJ: Lawrence Erlbaum Associates.
- Grusec JE, Davidov M (2007). Socialization in the family: The roles of parents. In J.E. Grusec & P.D. Hastings (Eds.), *Handbook of socialization: Theory and research* (pp. 284-308). New York: Guilford Press.
- Hammen K (2003). Risk and protective factors for children of depressed parents. Resilience and vulnerability: Adaptation in the context of childhood adversities, pp. 50 -75. New York: Cambridge University Press.
- Jazayeri M (2004). The Effect of Family Structure on Evolution of Advanced Personality. Thesis Submitted to Receive Masters Degree. Tehran: Al-Zahra University. Reihane J. 3:65-71.
- Henrich J, Robert B, Peter J. Richerson (2012). The puzzle of monogamous marriage. *Phil. Trans. R. Soc. B.* 367:657-669.
- Kann T, Hanna F (2008). Disruptive behavior disorders in children and adolescents: How do girls differ from boys? *J. Counsel. Dev.* 78(3):267-274.
- Karavasilis L, Doyle AB, Markiewicz D (2003). Associations between parenting style and attachment to mother in middle childhood and adolescence. *Int. J. Behav. Dev.* 27(2):153-164.
- Komsu N, Raikkonen K, Heinone K, Pesonen A, Keskivaara P, Jarvenpaa A, Strandberg TE. (2008). Transactional development of parent personality and child temperament. *Eur J. Pers.* 22:553-73.
- Leiyin C, Xuerong L, Zhen W, Bingqing G. (2011). Parenting styles, parenting locus of control and family function of children with oppositional defiant disorder. *J. Clin. Psychol.* 23:2-20.
- Madrigal AC (2007). The direct and indirect effect of family environment and community violence exposure on lotion middle-school age youths psychological distress and risk for gang affiliation. University of Nevada, Reno.
- McCartney K, Philips D (2006). *Blackwell handbook of early childhood development.* Blackwell publishing.
- Oliver PH, Wright Guerin D, Coffman JK (2009). Big five parental personality traits, parenting behaviors, and adolescent behavior problem: A meditational model. *Pers. Ind. Dif.* 47:631-6.
- Olson SL, Sameroff AJ, Kerr DC, Lopez NL, Wellman HM (2005). Developmental foundations of externalizing problems in young children: The role of effortful control. *Dev Psychopath.* 17:25-45.
- Pervin LA, John PO (1997). *Personality: Theory and research* 7th ed., New York: John Wiley and Sons.
- Tiger P, Tiger B (2004). *The Perfect Job for You (Do What You Were Made for).* Translated by Mahdi Gharache Daghi; Hassan Rahim Monfared. Tehran: Naghsho Negar.
- Rahmani F, Sayid F, Naeime B, Rezayi M, Sedaghat K (2006). The Relationship between Parenting Style and Behavioral Disorders of Adolescents in Tabriz Schools. Tehran: Papers Submitted to the Second National Congress on Pathology of Family in Iran. Family Research Centre, Shahid Beheshti University, P 182.
- Sadeghian F, Sheikh PN (2011). Importance of Typology of Personality for Students in Finding Jobs and Careers. *Quart. Educ. Anal. Inf.* Spring Summ. 3:8-12.
- Sarookhani B (1997). *Divorce: A Research on Its Reality and Causes.* Tehran: Tehran University Publication. P 1.
- Smetana JG (2011). *Adolescents, families and social development: How teens construct their worlds.* West Sussex, England: Wiley-Blackwell.
- Ekhtiari SN (2009). A Study on the Relationship between Parenting Styles and introverted and Extroverted Behavioral Disorders in Children Aged 8- 11. Thesis Submitted to Receive Masters Degree. Allame Tabatabayi University.
- Steinberg LD, Silk JS (2002). Parenting adolescents. In M.H. Bornstein (Ed.), *Handbook of parenting, vol. 1,* (pp. 103-134). Mahwah, NJ: Lawrence Erlbaum Associates.
- Stevenson BT, Akister HD (2008). The mcmaster model of family functionig observer and parental rating in a nonclinical sample. *Fam. Process.* 34:334-410.
- Taghavi K, Kalantari A (2006). A Study on the Evolutionary Dimensions of Psychology in High School Students of Tehran. Papers submitted in the Second National Congress on Pathology of Family in Iran. Family Research Centre, Shahid Beheshti University.
- Winslow K, Shaw M, Bruns S, Kiebler MG (2005). Parenting as a mediator on child behavior problems and maternal stress, support, and adjustment. Paper presented at the biennial meeting of the Society for Research in Child Development Indianapolis, IN.
- Zankman S, Bonomo J. (2004). Working with parents to reduce juvenile sex offender recidivism. *J. Child Sex Abuse* 134:139-156.

Full Length Research Paper

Determining science student teachers' cognitive structure on the concept of "food chain"

Derya Çınar

Necmettin Erbakan University, Turkey.

Received 26 October, 2015; Accepted 26 November, 2015

The current study aims to determine science student teachers' cognitive structure on the concept of food chain. Qualitative research method was applied in this study. Fallacies detected in the pre-service teachers' conceptual structures are believed to result in students' developing misconceptions in their future classes and will adversely affect their future teaching performance. The data were collected from 48 science student teachers. A free word association test was used as a data collection instrument. The data collected were subject to content analysis. Analyzing the science student teachers' responses to the concept of food chain on the free word association test, these responses were coded and divided into categories. Based on the categories, frequency and percentages were provided. The data collected through the study were divided into 8 categories, which were stated as follows: energy flow- producer, consumer, decomposer organisms- food chain and food pyramid relationship- ecologic factors- matters used in energy flow- terms related to vitality-deterioration in food chain- the characteristics of the population. When the words provided as answers by the science student teachers to the concept of food chain were analyzed, it was noticed that they had more word connections with energy flow and in terms of the elements that compose food chain. Moreover, it was determined that they had some misconceptions about food chain. Similar research can be conducted with different student groups and for the correction of alternative concepts related to the concept of food chain, Extra biology courses should be included in undergraduate curriculums.

Key words: Food chain, free word association test, misconception, cognitive structure.

INTRODUCTION

Issues such as how individuals think, remember and organize information are one of the most important research areas subject to interest of educational researchers for many years. Researchers in this field have attempted to develop various ways to enhance the cognitive structures of students. The cognitive structure is a structure based on assumptions and description of the

associations of the concepts in the long-term memory of students. Cognitive structure research aims to help teachers to know the schemata of the individual, to develop teaching strategies suitable for this schemata and to guide their students for the integration of their past experiences and newly-acquired information. Thus, teachers can offer guidance for their students to increase

E-mail: deryacinar42@gmail.com.

Authors agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

their meaningful learning. Knowing the schemata of students helps teachers not only to develop teaching strategies but also to conduct research on their students' conceptual changes (Wandersee et al., 1994). Biology educators also try to make use of the findings of cognitive structure research in practice.

Conceptual learning focuses on the structure and content of the information acquired by students or qualitative differences of concepts. Thus, students' prior knowledge can be learned and correctly structured and as a result learning can be realized by making meaningful connections with newly-acquired information (Tsai and Huang, 2002). Constructivist learning theories emphasize that learners play an important role in the construction of knowledge (Harrison and Treagust, 1996). In every day of their lives, students are in an interaction with the natural world; they observe the properties of the natural world and talk about the experiences and ideas of other people. As a result of their accumulated experiences, students can make their simple and primitive explanations more sophisticated or generalize the mental models of many phenomena involving life, astronomy, light, power and matter. These are intuitional thoughts or children's science (Gilbert et al., 1982). This affects students' teachers in the class because individual experiences are numerous and diverse. The effect of schemata on learning varies greatly from student to student. Students' definitions of scientific phenomena are usually exemplified by individual and original occurrences (Gilbert, 2007; Harrison and Treagust, 1996). Mental models are viewed to be an analog presentation constructed along individuals' cognitive functions, a special variety of mental presentations (Vosniadou, 1994). Mental models are also viewed to be interpretations of students' concepts. In the current study, in order to define students' understanding, the term *cognitive structure* was used.

There are many courses in which students experience comprehension difficulties and the reasons behind these difficulties may stem from the student, the teacher, the family, school conditions, the course, system etc. Biology course is also one of the courses students find difficult to understand in terms of its content (Bahar et al., 1999a; Çimer, 2012; Lazarowitz and Penso, 1992; Seymour and Longdon, 1991). In fact, though it is expected to be an interesting course as it involves the examination of living organisms, students may face some difficulties as they cannot comprehend the unity at the level of biologic organization and the course includes some abstract concepts (Jones and Rua, 2006; Lukin, 2013; Kurt, 2013a). While it was determined that students experience difficulties particularly in relation to systems, food chain is also among the topics found to be difficult by students.

One of the reasons lying on the basis of learning difficulties is students' not being able to associate the conceptual structures related to the given topic in their minds. The cognitive structure is an assumption-based

structure representing the relationships of the concepts in the long-term memory of a student. At that point, educators should provide guidance for students to increase their meaningful learning. In this regard, knowing the schemata of students helps teachers not only to develop teaching strategies but also to conduct research on their students' conceptual changes (Pines and West, 1986; Tsai and Huang, 2002); erroneous prior knowledge always adversely affects learning (CUSE, 1997; Wandersee et al., 1994). In this connection, biology educators try to make use of the findings of cognitive structure research in practice. Gilbert et al. (1998a, b) maintain that explanation of individuals' cognitive structures can be difficult and elicitation of individuals' opinions about key concepts can be of great importance in this regard. Gilbert and Boulter (1998) state that they see mental models as unreachable and thus concepts represent cognitive models and at that point, the importance of conceptual learning becomes apparent.

Great importance attached to the constructivist learning approach in instructional environments in recent years gave rise to different methods and strategies used to determine conceptual understanding and conceptual change (Vance et al., 1995). Researchers have been directed to methods used not only to reveal students' already acquired knowledge but also students' connections between concepts, cognitive structures, whether they can realize meaningful learning by associating their already acquired knowledge with new information and the extent to which students understand the similarities between the information they constructed in their minds and functioning of the events in the natural world and such techniques have gained great importance (Bahar, 2003; Bahar et al., 2006). Free word association test technique is among the most important measurement tools in this regard. The most general and the oldest one of these techniques and also the one employed in the current study is word association technique. This technique has been reported to be quite effective in eliciting individuals' conceptual structures and conceptual changes (Hovardas and Korfiatis, 2006).

Conceptual structure researches on food chain

Hogan and Fisher-Keller (1996) identified the difficulties experienced by students in the disassociation of the matter or its connection with photosynthesis in food cycle. Griffiths and Grant (1985) reported that students hold alternative concepts in food cycle analysis. The students defined photosynthesis processes as a component or an ingredient within the matter's ontological category and frequently mentioned the terminology-based use of the matter (Barak et al., 1999). They did not consider the dynamic nature and flow of the process. Here, ATP has an important role in photosynthesis processes and is

known as one of the basic end-products. Barak et al. (1999) reported that the responses given by the high school students to photosynthesis processes within the category of matter tend to emphasize the importance of one of the end-products. Most of the responses were found to be related to glucose production. They pointed out that the students hold misconceptions about photosynthesis, respiration and energy flow in food chain and they could not transfer their information into the subject of energy conservation (Barak et al., 1999).

High school students were reported to be unsuccessful in identifying the relationship between various concepts related to the subjects of matter cycle and energy flow. The topic the students found the most difficult to understand was the relationship between the living and nonliving worlds. The students' statements were analyzed under three categories. At the level of organism, energy flow and matter cycle can be defined referring to three main participants (producers, consumers and decomposers) and to ecological concepts of food chain. This is the category of information regarding natural phenomena. At the level of cell, energy flow and matter cycle can be involved in the processes of respiration and photosynthesis that are in the category of mechanical information and can be defined in terms of matter and energy existing in the category of physical information (Barak et al., 1999).

The most important difficulty involved in learning biology is its covering three dimensions of thinking; macro, micro and symbolic (Bahar et al., 1999a). In the cases of energy flow and matter cycle, the difference between macro and micro is relatively more complex. Information about natural phenomena is macro in comparison to mechanic and physical information and physical information is macro in comparison to mechanic information and information related to natural phenomena and mechanic information is micro in comparison to information about mechanic information and macro at the same time in comparison to physical information. Photosynthesis and respiration serve the function of a bridge between living world and non-living world in terms of energy flow and matter cycle (Lin and Hu, 2003). The focus of research is to develop the understanding of complex subjects and more emphasis is put on the construction of information on the basis of relationships within the information. Moreover, it focuses on the integration, function and process of biological information (Barak et al., 1999; Hogan and Fisher-Keller, 1996; Leach et al., 1996).

Understanding of connections between biological systems at macro and micro levels is of great importance for biological literacy (Bahar et al., 1999a). Students can not realize that both photosynthesis and respiration are energy reactions within biological systems. Photosynthesis and vegetative cellular respiration occur simultaneously within plants through multiple biochemical

steps (Lin and Hu, 2003). While categorizing the specialties and functions of organelles, students may not consider the relationships between the processes and may miss the importance of the plant as a function of independent biological systems within the local ecosystem as well as the global ecosystem. Organism is in an interaction within the ecosystem and affects the global environment. A plant is a system. Moreover, a plant is nested parts of a system. Every ecological level has its own features. For instance, green pigmentation cannot be analyzed at cellular level on its own, but when combined with the light, it becomes chlorophyll and its green color becomes apparent.

Photosynthesis and vegetative cellular respiration occur at more than one ecological level and within more than one complex system and students overlook actions occurring continuously and spontaneously at more than one ecological level (not step by step processes) (Chi, 2001). In Lin and Hu (2003), it was reported that pre-service classroom teachers experience mental confusions in defining how cellular respiration happens and photosynthesis. It was also determined that photosynthesis is viewed to be a source of energy and the students used light energy and food chain as evidence to support their view. One of the students stated that the sun realizes photosynthesis. The student also stated that the sun is a source of energy for plants and plays a productive role in vegetative food cycle. The participants frequently identified sun light as the source of energy but they could not provide its definition at biochemical level in a suitable context. Though all the reactions were considered at biochemical level, none of the participants mentioned the electrons involved in the process. Though they were able to conceptualize photosynthesis as an energy process, they found its definitions scientifically incomplete. The participants defined cellular respiration as an energy process. The pre-service teachers experienced difficulties in defining the relationship between food and energy.

As can be seen in the related literature, research conducted in the field of science education in recent years has revealed that students have alternative concepts in many subjects. In this regard, by means of free word association test technique, students' conceptual structure can be determined and alternative concepts can be solicited. However, in the related literature no study looking into pre-service science teachers' conceptual structures in relation to "food chain" by using free word association test technique was encountered. Thus, the findings of the current study employing free word association test technique are believed to make important contributions to the literature.

METHODOLOGY

In the current study, a qualitative research method was employed.

Besin zinciri : Denge
 Besin zinciri : Ekosistem
 Besin zinciri : Omnivor
 Besin zinciri : Enerji akarımı
 Besin zinciri : Otcul
 Besin zinciri : Etçil
 Besin zinciri : Artık madde
 Besin zinciri : Devamlılık
 Besin zinciri : Besin piramidi
 Besin zinciri :

Yukarıda yazdığımız kelimelerle ilgili bir cümle kurunuz :

Ekosistemin dengeli olabilmesi için sistemin parçaları dengeli çalışmalıdır. Örneğin besin zincirinin dengeli ve dengeli olarak çalışması gerekir. Birinin çalışması veya çalışması devamlılığını ortadan kaldırır. Bir tür çalışırken, diğer taraftan ortadan

Figure 1. Response paper of P33.

According to Yıldırım and Şimşek (2000), qualitative research is a research method aiming to discover individuals' views of a phenomenon and to uncover the processes belonging to this view. In qualitative research, the main purpose is not to reach generalizable results but rather to present a descriptive and realistic picture of the issue under investigation (Patton, 2014; Creswell, 2013). In qualitative research, for the reliability and validity of the research findings, presentation of the data in a detailed and direct manner is of great importance.

Study group

The participants of the current study conducted in 2014 to 2015 academic year are 48 senior pre-service science teachers attending the Department of Science Teaching at the Ahmet Keleşoğlu Education Faculty of Necmettin Erbakan University, Turkey. The participants are in the age group of 20 to 21. The reason for the selection of these pre-service teachers is that biology courses are given to students in the department of science education in each term and it is the science teachers' responsibility to teach these biology subjects to students in the second level of elementary education.

Data collection instruments

In the current study, free word association test was used as a data collection instrument. By using this test, it was intended to collect

detailed information about the pre-service teachers' conceptual structures related to food chain. Information is given about this measurement tool.

Free word association test

This data collection technique, widely used in the field of science to collect data (Ad and Demirci, 2012; Aydın and Taşar, 2010; Bahar et al., 1999b; Daskolia et al., 2006; Ercan et al., 2010; Köseoğlu and Bayır, 2011; Nakiboğlu, 2008; Özatlı and Bahar, 2010; Timur and Taşar, 2011; Torkar and Bajd, 2006), has been started to be employed by some social studies in recent years (Işıklı et al., 2011; Kurt, 2013a, b, c; Kurt et al., 2013a, b, c, d).

Free word association test is one of the most widely used techniques to elicit individuals' cognitive structures related to certain concepts and the links between the concepts in this structure; that is, to analyze the information network and to determine whether the relationships between the concepts in the long-term memory are adequate or not (Atasoy, 2004; Bahar and Kılıçlı, 2001; Bahar and Özatlı, 2003; Cardellini and Bahar, 2000; Nartgün, 2006). This technique is based on the idea of expressing the thoughts coming to the mind in relation to the stimulating word without any limitation (Bahar et al., 1999b; Sato and James, 1999). In the present study, the pre-service teachers were asked the concept of "food chain" to complete the free word association test. In this test, the concept of food chain is presented as a stimulator in the following format. In Figure 1, one example set of data collected through the free word association technique belonging to the participant K33 is given.

As can be seen in the sample test given in Figure 1, the free word association test is comprised of two stages. *In the first stage*; The participants must express the concepts that are brought to their minds by the stimulating word within a certain time limit that is 40 s for the current study (Gussarsky and Gorodetsky, 1990). The pre-service science teachers were asked to write the first ten words that come to their minds when they read or hear the term “food chain” within 40 s. The test is designed in such a way that the students have to go back to the key concept after writing each related concept so that they are not affected from the associated concepts but from the key concept. Thus, the test serves its intended purpose.

In the second stage; the participants were asked to write sentences related to the key concept within 20 s and in the data analysis process, each sentence was separately analyzed because the response sentence associated with the key concept might be a product of connotation at recall level that does not have a meaningful relationship with the key concept. Furthermore, as the related sentence will be more complex and have a more sophisticated structure than a single response word, whether the sentence is scientific or whether it includes misconceptions with different characteristics affects evaluation process.

Analysis of data

To start with data analysis, first the participants’ response papers were enumerated. The data were analyzed according to content analysis method. The main purpose of content analysis is to reach concepts and relationships that can explain the data. For this purpose, similar data are gathered around certain concepts and themes and organized and interpreted in such a way as to be understood by the reader (Yıldırım and Şimşek, 2006).

The data collected by means of the free word association technique were analyzed by using the number of words, the number of responses and meaningful relationship technique (Atasoy, 2004). The words connotating the same meaning were classified under the most frequently repeated words. Many words regarded to be unrelated to other words and words repeated only once were not included in the analysis. The words were categorized by using the meaningful relationship criterion and frequencies of the words in each category were calculated. A great deal of research shows that this type of data analysis technique yields reliable results (Daskolia et al., 2006; Kostova and Radoynovska, 2008; Kostova and Radoynovska, 2010). Two important processes were conducted to establish the validity of the research results: data coding and analysis processes (how the conceptual category has been reached) were explained in detail (Hruschka et al., 2004); excerpts believed to best represent each category were selected and presented in the findings section (Yıldırım and Şimşek, 2006).

In order to establish the reliability of the study, the codes and the relationships related to the codes found by two researchers were compared to confirm whether the codes given under the conceptual categories actually represent these conceptual categories. After the research data were separately coded by two experts in the field of science, final form of the list of codes and themes was given considering the opinions of the researcher. The consistency of the codes used by the researchers separately from each other was determined by making markings as “agreement” and “disagreement”. Cases in which the researchers used the same codes for the students’ opinions were considered to be agreement and cases in which they used different codes were considered to be disagreement. In cases in which one of the researchers ran into a contradiction, coding was performed by seeking the opinion of the other researcher. The reliability of the data analysis conducted in this way was calculated by using this formula; (Agreement /

(Agreement + Disagreement) x 100) (Miles and Huberman, 1994; Kurt, 2013a, b, c; Kurt et al., 2013a, b, c, d). Inter-rater reliability was found to be 90%.

On the other hand, in the construction of the model of the students’ cognitive structures related to food cycle NVivo9 program was used.

FINDINGS

As a result of the analysis of the pre-service science teachers’ cognitive structures related to food chain, totally 8 categories of the words were constructed. These categories and the words involved in each category were listed. When a word was repeated once, it was excluded from the evaluation. Thus, a total of 42 words (10.57%) were not included within the categories. These words are also not presented in Table 1; yet, at the end of each category evaluated, they are mentioned in the related comments section. As a result, the remaining 60 words were assigned into 8 categories. In Table 1, the categories and the words in each category are listed. Totally 397 response words were obtained.

As a result of the collected data, it was observed that the pre-service teachers put the greatest emphasis on the concept of “energy flow” in relation to the concept of food chain; thus, the most prominent category was determined to be “energy flow” (f=190). In this category, while most of the participants focus on words such as “producer”, “decomposer”, “consumer”, “energy”, “carnivore”, “herbivore”, “omnivore”, some of them mentioned concepts such as “primary consumer”, “secondary consumer”, “cycle”, “autotroph”, “prey-hunter”, “green plants”, “tertiary consumer”, “predator” and “sun light”. In this category, there are some words not included in the list of the category as they were only repeated once; “weight”, “10% law”, “step”, “eating each other”, “convection” and “chain”. These results show that the participants created the most connections with the category of “energy flow” in relation to the concept of food chain.

In the second category, the participants offered associations regarding “producer, consumer, decomposer organisms” (f=98). In this category, most of the participants used the words such as “plant”, “weed”, “snake”, “sheep”, “animal”, “grasshopper”, “eagle”, “human” and “lion” and few of the participants focused on the concepts they could see around such as “worm”, “mouse”, “tenia”, “frog”, “hawk” and “bacteria”. The words not included in this category as they were only once written are; “vulture”, “crocodile”, “pigeon”, “cow” and “rabbit”. These results indicate that the participants’ cognitive structures related to food chain are quite restricted.

The third category was constructed under the heading of “food chain and food pyramid relationship” (f=37). While most of the participants used to concepts of “food

Table 1. Distribution of science student teachers' cognitive structures about "food chain" by categories.

Categories	Concepts under categories and their frequencies	Total frequencies of categories
Energy flow	Producer (32)	190
	Decomposer (25)	
	Consumer (21)	
	Energy (21)	
	Carnivore (19)	
	Herbivore (14)	
	Omnivore (11)	
	Primary consumer (9)	
	Secondary consumer (9)	
	Cycle (7)	
	Autotroph (6)	
	Prey-hunter (4)	
	Green plants (4)	
	Tertiary consumer (3)	
Predator (3)		
Sunlight (2)		
Producer, consumer, decomposer organisms	Plant (15)	98
	Weed (12)	
	Snake (10)	
	Sheep (9)	
	Animal (8)	
	Grasshopper (8)	
	Eagle (7)	
	Human (6)	
	Lion (6)	
	Worm (4)	
	Mouse (3)	
	Tenia (3)	
	Frog (3)	
	Hawk (2)	
Bacteria (2)		
Food chain and food pyramid relationship	Food pyramid (15)	37
	Food (7)	
	Eating (4)	
	Microorganism (4)	
	Parasite (3)	
	The number of living things (2)	
Triangle (2)		
Ecologic factors	Ecologic balance (6)	37
	Ecosystem (6)	
	Soil (5)	
	Water (4)	
	Ecologic activities (3)	
	Photosynthesis (3)	
Respiration (3)		

Table 1. Cont'd

	Continuity (3)	
	Air (2)	
	Earth (2)	
	Waste (2)	
	CO ₂ (2)	
Matters used in energy flow	Carbohydrate (2)	
	O ₂ (2)	12
	Protein (2)	
	Fat (2)	
Terms related to vitality	Living entity (9)	11
	Reproduction (2)	
Deterioration in food chain	Increase in the number of members (4)	
	Decrease in the number of members (2)	6
The characteristics of population	Competition (4)	6
	Survival of the population (2)	-
Total	60 words	397

pyramid", "food", "eating" and "microorganism", relatively fewer participants mentioned the words; "parasite", "the number of living things" and "triangle". Moreover, the words not included in this category as they were only written once are; "commensalism", "small", "mass" and "ordering". In this regard, it can be argued that the conceptual validity of the pre-service science teachers' cognitive structures about "food chain and food pyramid relationship" is not adequate.

In the fourth category, the participants' words related to "ecologic factors" are collected (f=37). In this category, the participants mentioned concepts such as "ecologic balance", "eco-system", "soil", "water", and "ecologic activities". The word not included in this category as it was only written once is "sun". It is seen that the participants' cognitive structures in relation to "ecologic factors" are quite restricted. In the fifth category, the participants' words related to "matters used in energy flow" are gathered (f=12). In this category, most of the participants focused on the concepts of "waste", "CO₂", "carbohydrate", "oxygen", "protein" and "fat". The word not included in this category as it was only written once is "nitrogen".

The sixth category of the words associated with the concept of food chain by the participants was constructed under the heading of "terms related to vitality" (f=11). The words written in association with this theme are "living entity" and "reproduction". The words not included in this category as they were only written once are; "non-living thing" and "growth". From the words written by the

participants, it was observed that the participants could not create connections with other concepts.

The seventh category was constructed under the heading of "deterioration in food chain" (f=6). In this regard, the participants used the words "increase in the number of members" and "decrease in the number of members". As the words "harm to the field" and "harm to human" were written once, they were not included in this category. The last category was named as "the characteristics of the population" (f=6). In this category, the participants focused on the concepts of "competition" and "survival of the population". In addition, some excerpts of the pre-service teachers from their explanations about food chain are presented under the related themes together with their analyses below:

The participants' explanations about the category of "energy flow";

"Food chain is the flow of energy among living organisms" (K27)

"...food chain is the flow of energy occurring as a result of cycles taking place among producers, consumers and decomposers" (K28)

The participants' explanations about the category of "food chain and food pyramid relationship";

"The order generally represented by consumers, producers and decomposers in the food pyramid and ensuring vitality and balance can be called food chain" (K37)

"Food chain ensures the natural balance" (K40)

The participants' explanations about the category of *"ecologic factors"*;

"For the eco-system to be in balance, the constituents of the system must function properly. Therefore, food chain should function regularly and in a balanced manner" (K33)

"For the maintenance of the eco-system, food chain should sustain its existence together with its members" (K35)

The participants' explanations about the category of *"deterioration in food chain"*;

"...increasing or decreasing population of one of them may pose a threat to survival. While one species is proliferating, another one may become extinct" (K33)

When the given excerpts examined, it is seen that the pre-service teachers did not write sentences for each category and they wrote more sentences for the category of *"energy flow"*. This clearly shows that the prominent theme is the *"flow of energy"*. This may indicate that the pre-service teachers first try to create a conceptual structure of what food chain is in their minds and they cannot create links between food chain and food pyramid. It can be argued that as result of rote learning, some students could not produce any sentences and some others could not make meaningful sentences. Moreover, the findings of the current study revealed that the pre-service teachers hold some alternative concepts in relation to food chain. Some sample alternative concepts stated by the participants in relation to the category *"energy flow"* are given below:

"transfer of food from plants to animals like a chain" (K29)

this statement shows that the participant has an alternative concept because in plants and animals, energy transfer is out of question. When the words written by this participant are examined, it is seen that he/she used the word *"decomposer"* but did not use it in a sentence and holds an erroneous concept. In this regard, this statement of the participant is incomplete and wrong. Another participant's statement *"food chain starts with producers, producers produce their own food"* (K30) shows that he/she has some missing information because he/she did not mention consumers and decomposers. Yet another participant's statement *"it is a cycle"* shows that he/she has missing and erroneous information because though the term *"cycle"* is correct, it may mean many things. What are the constituents of the cycle? He/she did not mention these constituents. Some sample alternative concepts stated by the participants in relation to the category *"producer, consumer and decomposer organisms"* are given as:

"at the bottom of food chain are there plants and at the top

of it are there animals" (K39)

this statement shows that the participant has missing and erroneous information because he/she did not mention decomposer organisms. Some sample alternative concepts stated by the participants in relation to the category *"food chain and food pyramid relationship"* are given below:

"food chain is like eating" (K35)

this statement is not correct and also no explanation was written for this sentence. The reason for this analogy should be explained. Some sample alternative concepts stated by the participants in relation to the category *"matters used in energy flow"* are given below:

"requirements of life cycle are carbohydrate, protein and fat..." (K42)

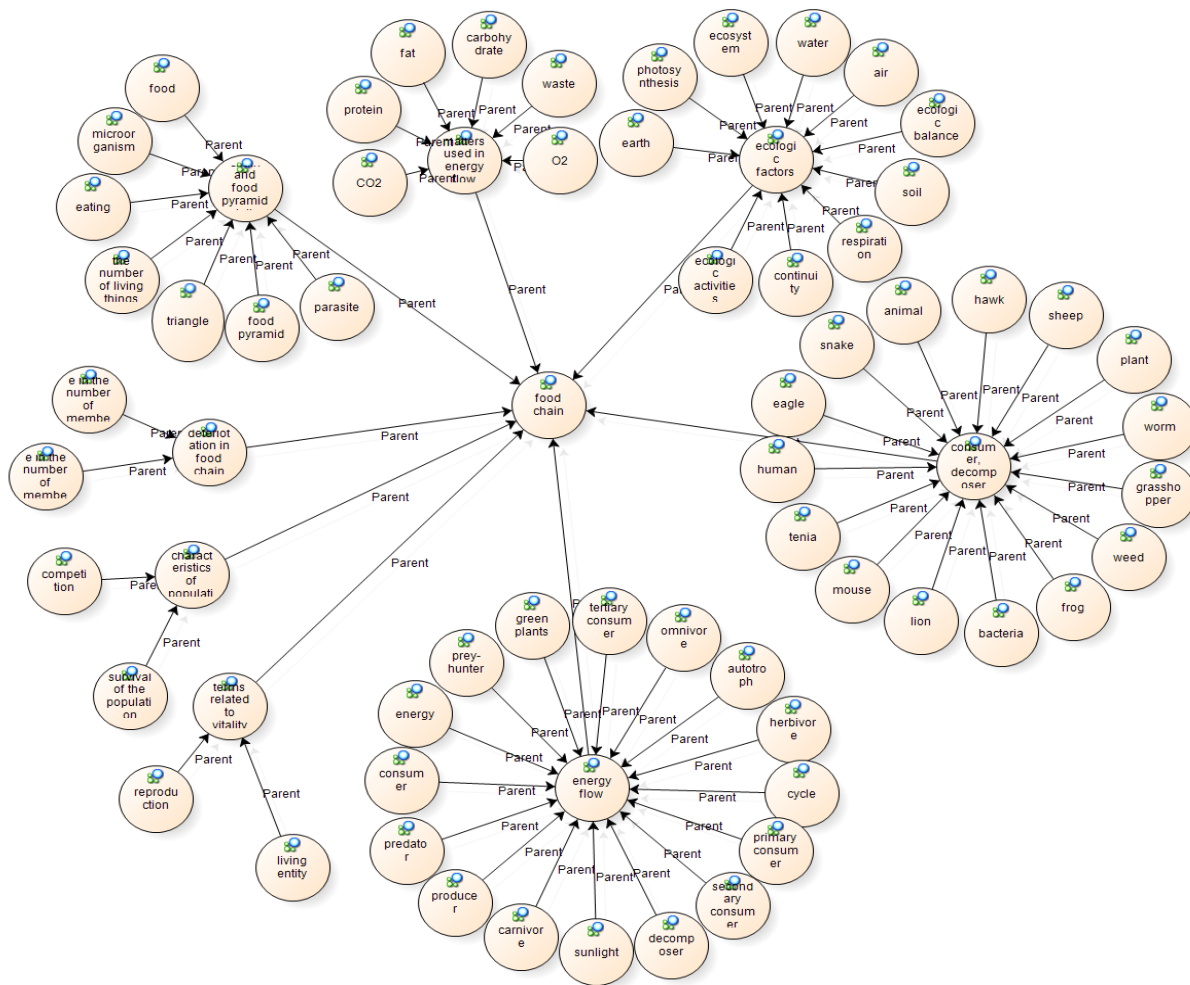
this statement shows that the participant is lacking some information because they are not only these matters. There are some other matters very important for living entities. By evaluating the data of the current study, a model related to the pre-service science teachers' cognitive structures of food chain was constructed (Model 1). As can be seen in the model, the pre-service science teachers' conceptual structures regarding food chain emerged in association with 8 categories.

DISCUSSION

The current study was designed to identify the pre-service science teachers' cognitive structures related to food chain by determining their conceptual constructs. As the pre-service science teachers' conceptual constructs related to the concept of food chain are of great importance for the construction of science-related concepts, the results of the current study are believed to make important contributions to literature.

In the literature, it has been reported that students are unsuccessful in relating to what they have learned from different disciplines of science to their lives and unable to comprehend the relationships between what is scientific and what is not (Enginar et al., 2002; Özmen, 2003; Palmer, 1999; Taşdemir and Demirbaş, 2010; Yiğit et al., 2002) and that pre-service science teachers included positive and negative associations in their response words related to food chain. In this regard, the words produced by the pre-service science teachers reflect their academic concepts, their relating these concepts to daily life and their explaining academic concepts with the terms of daily speech etc. What is more important here?

Correct construction of an academic concept or academically correct expression of it?



Model 1. Cognitive structures science student teachers' about food chain.

In the current study, the words elicited by means of the free word association test were gathered under 8 categories. These are; “energy flow”, “producer, consumer and decomposer organisms”, “food chain and food pyramid relationship”, “ecologic factors”, “matters used in energy flow”, “terms related to vitality”, “deterioration in food chain” and “characteristics of the population”.

In light of the results obtained within the themes constructed, it can be argued that the pre-service science teachers most strongly associated the word of “*food chain*” with “*energy flow*”. Thus, it cannot be maintained that the pre-service science teachers’ cognitive structures related to food chain have a scientific conceptual validity because of their statements related to food chain such as “*transfer of food from plants to animals like a chain*” (K29;40); such statements show that they have alternative concepts. Griffiths and Grant (1985) reported that the students have alternative concepts in the analysis of food

chain. Hogan and Fisherkeller (1996) detected the difficulties experienced by the students in the dissociation of the matter or relating it to photosynthesis in food chain. They pointed out that the students have some misconceptions about photosynthesis, respiration and energy flow in food chain and they could not transfer their information into the subject of energy conservation (Barak et al., 1999).

It was also reported that high school senior students are unsuccessful in identifying the relationships between various concepts related to the topics of matter cycle and energy flow. The topic the students found the most difficult to understand was the relationship between the living and nonliving worlds. Photosynthesis and respiration serve the function of a bridge between living and non-living worlds in terms of energy and matter cycle (Lin and Hu, 2003).

In the current study, it was determined that the pre-

service science teachers could not make sense of photosynthesis and sun light within the context of food chain process. It was also determined that the participants could not relate these concepts with these words and could not make meaningful sentences. Lin and Hu (2003) found that photosynthesis is viewed to be a source of energy and the students used light energy and food chain as evidence to support their view. One of the students stated that the sun realizes photosynthesis. The student also stated that the sun is a source of energy for plants and plays a productive role in vegetative food cycle. The participants frequently identified sun light as the source of energy but they could not provide its definition at biochemical level in a suitable context. In the current study, they did not view sun light as a source of energy and did not use it in a suitable context.

The measurement tool revealed the inadequacy of the pre-service science teachers' information about the categories of "ecological factors", "terms related to living organisms", "deterioration in food chain" and "characteristics of the population". The participants were not able to write sentences in relation to these categories. The relationships of the response words with these categories were found to be inadequate. Thus, it can be argued that the participants have missing information. There are many reasons for not being able to construct conceptual structures and one of them is the existence of many similar wrong definitions in text books and this makes the understanding of the concepts difficult and leads to confusion.

In this regard, teacher education programs should promote the conceptual development of pre-service teachers, help them to develop their professional competencies and impart the required qualifications to them so that they can detect their students' learning difficulties during their professional career (Yip, 1998). Given that even when they are given the necessary training, students may have great difficulties in changing the internalized erroneous concepts, it becomes clear that this is a process that should be taken seriously.

Conclusion

Attaching importance to concept teaching and conceptual learning at every level of schooling and organization of the required educational-instructional activities for this purpose are of great importance for meaningful learning to occur. On the other hand, through the provision of training about how to use cognitive strategies accurately, pre-service science teachers can learn the concepts successfully, and thus their cognitive structures of the concepts can be rendered permanent and accurate.

Conflicts of interest

The author has not declared any conflict of interests.

REFERENCES

- Ad VNK, Demirci N (2012). Prospective teachers' levels of associating environmental problems with science fields and thermodynamics laws. *Ahi Evran Univ. J. Kırşehir Educ. Faculty* 13(3):19-46
- Atasoy B (2004). *Science education and teaching*. Ankara: Asil Publishing House
- Aydın F, Taşar MF (2010). An investigation of pre-service science teachers' cognitive structures and ideas about the nature of technology. *Ahi Evran Univ. J. Kırşehir Educ. Faculty* 11(4):209-221.
- Bahar M, Johnstone AH, Hansell MH (1999a). Revisiting learning difficulties in biology. *J. Biol. Educ.* 33:84-86.
- Bahar M, Johnstone AH, Sutcliffe RG (1999b). Investigation of students' cognitive structure in elementary genetics through word association tests. *J. Biol. Educ.* 33:134-141.
- Bahar M (2003). Misconceptions in biology education and conceptual change strategies. *Educational Sciences: Theory Pract.* 3(1):27-64.
- Bahar M, Nartgün Z, Durmuş S, Bıçak B (2006). *Traditional and alternative assessment teachers Handbook*. Ankara: PegemA Publishing.
- Barak J, Sheva B, Gorodetsky M (1999). As 'process' as it can get: students' understanding of biological processes. *Int. J. Sci. Educ.* 21:1281-1292.
- Cardellini L, Bahar M (2000). Monitoring the Learning of Chemistry through Word Association Tests. *Austr. Chem. Res. Book* 19:59-69.
- Chi M (2001). Why Do Students Fail to Understand Complex Dynamic Concepts? Paper delivered to American Education Research Association, Seattle, April 10-14, 2001.
- Creswell JW (2013). *Qualitative research methods*. 3. Turn the pressure. (Translation Edit: Bütün, M., Demir, S. B.). Ankara: Siyasal Bookstore.
- CUSE (Committee on Undergraduate Science Education) (1997). *Misconceptions as barriers to understanding science. science teaching reconsidered: A Handbook*. Washington, D. C.: National Academy Press.
- Çimer A (2012). What makes biology learning difficult and effective: students' views? *Educ. Res. Rev.* 7(3):61-71.
- Daskolia M, Flogaitis E, Papageorgiou E (2006). Kindergarten teachers' conceptual framework on the ozone layer depletion. Exploring the Associative Meanings of a Global Environmental Issue. *J. Sci. Educ. Technol.* 15(2):168-178.
- Enginar İ, Saka A, Sesli E (2002). The levels of secondary school students making connection between daily life and the knowledge gained during biology lectures. V. *International Science and Mathematics Educational Congress*, Ankara.
- Ercan F, Taşdere A, Ercan N (2010). Observation of cognitive structure and conceptual changes through word associations tests. *J. Turk. Sci. Educ.* 7(2):136-154.
- Gilbert JK, Osborne RJ, Fensham PJ (1982). Children's science and its consequences for teaching. *Sci. Educ.* 66(4):623-633.
- Gilbert JK, Boulter CJ (1998). Learning science through models and modeling. In: K Tobin and B Frazer (Eds). *The international handbook of science education*. Dordrecht: Kluwer pp. 53-66.
- Gilbert JK, Boulter C, Rutherford M (1998a). Models in explanations, part 1, Horses for courses? *Int. J. Sci. Educ.* 20:83-97.
- Gilbert JK, Boulter C, Rutherford M (1998b). Models in explanations, part 2, Whose voice? Whose ears? *Int. J. Sci. Educ.* 20:187-203.
- Gilbert JK (2007). Visualization: A metacognitive skill in science and science education. In: J. K. Gilbert (Ed.), *Visualization in Science Education*. Dordrecht, the Netherlands: Kluwer Academic Publishers pp. 9-27.
- Griffiths AK, Grant BAC (1985). High school students' understanding of food webs: identification of a learning hierarchy and related misconceptions. *J. Res. Sci. Teach.* 22:421-436.
- Gussarsky E, Gorodetsky M (1990). On the concept "chemical equilibrium: The associative framework. *J. Res. Sci. Teach.* 27(3):197-204.
- Harrison AG, Treagust DF (1996). Secondary students' mental models of atoms and molecules: Implications for teaching chemistry. *Sci. Educ.* 80(5):509-534.

- Hogan K, Fisher Keller J (1996). Representing students' thinking about nutrient cycling in ecosystems: bidimensional coding of a complex topic. *J. Biol. Educ.* 33:941-970.
- Hovardas T, Korfiatis KJ (2006). Word associations as a tool for assessing conceptual change in science education. *Learn. Instr.* 16:416-432.
- Hruschka DJ, Schwartz D, St. John DC, Picone-Decaro E, Jenkins RA, Carey JW (2004). Reliability in coding open-ended data: lessons learned from HIV behavioral research. *Field Methods* 16(3):307-331.
- Işık M, Taşdere A, Göz NL (2011). Investigation teacher candidates' cognitive structure about principles of Ataturk through word association Test. *Uşak Univ. J. Soc. Sci.* 4(1):50-72.
- Jones MG, Rua MJ (2006). Conceptual representations of flu and microbial illness held by students, teachers, and medical professionals. *School Sci. Math.* 108(6):263-278.
- Kostova Z, Radoynovska B (2008). Word association test for studying conceptual structures of teachers and students. *Bulgarian J. Sci. Educ. Policy* 2(2):209-231.
- Kostova Z, Radoynovska B (2010). Motivating students' learning using word association test and concept maps. *Bulgarian J. Sci. Educ. Policy* 4(1):62-98.
- Köseoğlu F, Bayır E (2011). Examining cognitive structures of chemistry teacher candidates about gravimetric analysis through word association test method. *Trakya Univ. J. Educ. Faculty* 1(1):107-125.
- Kurt H (2013a). Determining biology teacher candidates' conceptual structures about energy and attitudes towards energy. *J. Baltic Sci. Educ.* 12(4):399-423.
- Kurt H (2013b). Turkish student biology teachers' conceptual structures and semantic attitudes towards microbes. *J. Baltic Sci. Educ.* 12(5):608-639.
- Kurt H (2013c). Biology student teachers' cognitive structure about "living thing. *Educ. Res. Rev.* 8(12):871-880.
- Kurt H, Ekici G, Aksu Ö, Aktaş M (2013a). The most important concept of transport and circulatory systems: Turkish biology student teachers' cognitive structure. *Educ. Res. Rev.* 8(17):1574-1593.
- Kurt H, Ekici G, Aksu Ö, Aktaş M (2013b). Determining cognitive structures and alternative conceptions on the concept of reproduction (The case of pre-service biology teachers). *Creative Educ.* 4(9):572-587.
- Kurt H, Ekici G, Aksu Ö, Aktaş M (2013c). Determining biology student teachers' cognitive structure on the concept of "diffusion" Through the Free word-association test and the drawing-writing technique. *Int. Educ. Stud.* 6(9):187-206.
- Kurt H, Ekici G, Aksu Ö, Aktaş M (2013d). Determining biology student teachers' cognitive structures about "germination. *Eur. J. Soc. Sci.* 39(4):582-594.
- Lazarowitz R, Penso S (1992). High school students' difficulties in learning biology concepts. *J. Biol. Educ.* 26(3):215-224.
- Leach J, Driver R, Scott P, Wood-Robinson C (1996). Children's ideas about ecology 2: ideas found in children aged 5-16 about the cycling of matter. *Int. J. Sci. Educ.* 18:19-34.
- Lin CY, Hu R (2003). Students' understanding of energy flow and matter cycling in the context of the food chain, photosynthesis, and respiration. *Int. J. Sci. Educ.* 25(12):1529-1544.
- Lukin K (2013). Exciting middle and high school students about immunology: an easy, inquiry-based lesson. *Immunol. Res.* 55(1-3):201-209.
- Miles MB, Huberman AM (1994). *Qualitative data analysis: an expanded sourcebook* (2nd ed.). Thousand Oaks, California: SAGE.
- Nakiboğlu C (2008). Using word associations for assessing nonmajor science students' knowledge structure before and after general chemistry instructions: The case of atomic structure. *Chem. Educ. Res. Pract.* 9:309-322.
- Nartgün Z (2006). *Assessment and evaluation in science and technology education*. M. Bahar (Ed.). Science and technology education. Ankara: PegemA Publishing.
- Özatlı NS, Bahar M (2010). Revealing students' cognitive structures regarding excretory system by new techniques. *Abant İzzet Baysal Univ. J.* 10(2):9-26.
- Özmen H (2003). The level of chemistry student teachers of relating their chemistry knowledge to events in daily life. *Kastamonu Educ. J.* 11(2):317-324.
- Palmer DH (1999). Exploring the Link between students' scientific and nonscientific conceptions. *Sci. Educ.* 83:639-653.
- Patton MQ (2014). *Qualitative research and evaluation methods*. 3. Turn the pressure. (Translation Edit: Bütün, M., Demir, S. B). Ankara. PegemA Publishing.
- Pines A, West L (1986). Conceptual understanding and science learning: an interpretation of research within sources-of knowledge framework. *Sci. Educ.* 70(5):583-604.
- Sato M, James P (1999). "Nature" and "Environment" as perceived by University students and their supervisors. *Int. J. Environ. Educ. Inform.* 18(2):165-172.
- Seymour J, Longdon B (1991). Respiration-That's Breathing Isn't It? *J. Biol. Educ.* 23(3):177-184.
- Taşdemir A, Demirbaş M (2010). The level of correlation of concepts that primary students seen topics in science and technology class with daily life. *Int. J. Humanit.* 7(1):125-148.
- Timur B, Taşar MF (2011). Developing pre-service science teachers' cognitive structures about technology: Word Association Test (WAT). *Western Anatolia J. Educ. Sci.* pp. 131-138.
- Torkar G, Bajd B (2006). Trainee teachers' ideas about endangered birds. *J. Biol. Educ.* 41(1):5-8.
- Tsai CC, Huang CM (2002). Exploring students' cognitive structures in learning science: A review of relevant methods. *J. Biol. Educ.* 36:163-169.
- Vance K, Miller K, Hand B (1995). Two examples of using constructivist approaches to teach ecology at the middle school level. *Am. Biol. Teacher* 37(4):244-249.
- Vosniadou S (1994). Capturing and modelling the process of conceptual change. *Learn. Instr.* 4:45-69.
- Wandersee JH, Mintzes JJ, Novak JD (1994). Research on alternative conceptions in science. In: Gabel DL (Eds.). *Handbook of research on science teaching and learning*. Simon & Schuster and Prentice Hall International, New York pp. 177-210.
- Yıldırım A, Şimşek H (2000). *Qualitative research methods*. Ankara: Seçkin Publishing.
- Yıldırım A, Şimşek H (2006). *Qualitative research methods in the social sciences*. Ankara: Seçkin Publishing.
- Yiğit N, Devicioğlu Y, Ayvacı HŞ (2002). Primary science students association of daily life in patients with events and levels. V. *International Sciences and Mathematics Education Congress*, Ankara.
- Yip DY (1998). Identification of misconceptions in novice biology teachers and remedial strategies for improving biology learning. *Int. J. Sci. Educ.* 2(4):461-477.

Educational Research and Reviews



Related Journals Published by Academic Journals

- African Journal of History and Culture
- Journal of Media and Communication Studies
- Journal of African Studies and Development
- Journal of Fine and Studio Art
- Journal of Languages and Culture
- Journal of Music and Dance

academicJournals