

13th International Educational Technology Conference

The Analysis of the Effects of Olfactive Stimulus in Learning in Context of Educational Technology

Burhan Akpınar^a *, Faysal Özdaş^b, Bilal Yıldırım^c, Veli Batdı^d*aAssoc. Prof. Dr. Firat University, Elazığ, 23119 Türkiye.**b Research Asist.Mardin Artuklu University, Mardin, Türkiye.**cResearch Asist. Mustafa Kemal University, Hatay, Türkiye.*

Abstract

When the educational Technologies, which are used in the process of learning-teaching process, are associated with sensory organs, the least used one becomes the olfactive stimuli. Nowadays, because of being foreground of visual-audio Technologies, Positivism is based on vision and audition but it ignores the other senses. Although seeing and hearing play important roles, the ineffectiveness of other senses is delusion in this process. In this delusion the impact of visual-audio Technologic devices from telescope to television, internet, mobile phones is inevitable. However sensation and learning is wholistic and based on togetherness of five senses. Thus, with the delusion olfactive stimulus which is rejected from the educational field is effective on senses, attention, concentration and memory in learning.

The purpose of this study, which is in form literature review, is to discuss the nature of olfactive stimulus , the effectiveness in education, areas of usage in context of educational technology, to deduce and to make suggestions.

© 2013 The Authors. Published by Elsevier Ltd.

Selection and peer-review under responsibility of The Association of Science, Education and Technology-TASET, Sakarya Universitesi, Turkey.

Key Words: Olfactive stimulus, Olfactive educational technology, Sense of smell and learning.

1. Introduction

Can many notions, strategies and methods used in classes at present as if they were pedagogical principles and necessities in fact be composed of an inclination? When these practices, which are called inclinations since they have been implemented for a long time are considered closely, the case can be understood better. Moreover,

* Corresponding author. Tel.: +90 533 691 10 75; fax: +90 (424) 236 50 64.

E-mail address: bakpinar@firat.edu.tr; bakpinar23@gmail.com

it is a fact that these practices that are implemented without questioning in the classrooms are indeed inclinations “dressed with pedagogy”, impositions, inducements and deceptions. This case is more common in countries like Turkey, which constantly import without knowing (in terms of source, meaning and context) what they get.

A typical example of this deception is concerned with the role of sense organs in the process of learning. Currently, sight and hearing have been regarded as the sole ways of learning in the notion of education in Turkey. This presupposition resulting from positivism, the source of which is a reality of the civilisation of the west, prevails all the phases of education in theory and practice. As a matter of fact, philosophers like Aristoteles, Darwin, Freud, Arnheim, Condillac and Kant, who are the important keystones of western culture, consider sight and hearing as intellectual “superior” senses; and other senses as animal “inferior” senses. Darwin and Freud among them overshot the mark and stressed “sight” as the sense of civilisation. These views gained ground and accepted as culture with the support of visual technologies like photograph, cinema, telescope and television that became widespread in the west especially in 19th and 20th centuries (Howes, 2002 as cited in Classen, 1997).

Another reason of ignoring the senses except for sight and hearing in the perception and learning process is that research on these senses is limited. Even though some part of this results from cultural bias, the subjective quality of senses with bio-chemical transmission system (olfaction and tasting) depending too much on personality characteristics is an important factor (Finnegan, 2002; Köster, 2002; Hudson and Distel, 2002; Bodnar et al., 2004). Finnegan (2002) stated that underestimating the olfaction in daily culture was an approach that is ideological and having a historical content. Departing from the studies carried out by Paabo, Holden (2004), who considered the subject anthropologically stated that smell genes adapted themselves to visuality by transforming as visuality was assigned more importance. If all these are true, it can be said that visuality leads to functional defects in olfactive perception and it usurps the roles of olfactive sense not only in cultural respect but also in biological respect.

The culture (ideology) deeming sight and hearing senses as the sole way in education prevails in Turkey as if it were a scientific principle. All the central exams having a critical role in determining the destiny of individuals in Turkey are carried out with this presupposition in mind. When the issue is handled in the context of Multiple Intelligences Theory, it can be claimed that central exams favour the ones with dominant “visual” ability. The fact that people are mostly visual or sight has a significant role in perception and learning does not alleviate this problem. In education, each individual no matter what his/her personal qualities are is valuable and should not be pushed out of the system. Above all, this is necessary for “justice in education”. The example cited here is a typical example of the fact that what wrong presupposition concerning pedagogy, epistemology, intelligence etc. can lead to in practice.

Another drawback of deeming the senses of sight and hearing as the unique ways of learning in education is that this viewpoint delays the comprehension of the phenomena of perception and learning with all their dimensions. Furthermore, this viewpoint, which can be summarised as sight and hearing’s shadowing the roles of other senses, has resulted in an error (at least a deficiency) of “prioritising only visual-audio stimuli and ignoring others” in the practices of instructional design and educational technology. This notion has led to a one-way pedagogical notion like “the setting teaches” in the realm of educational technology with the support of behaviourism and resulted in the underestimation of instructional methods in the process of instruction and learning. Focusing on just the setting or prioritising one or two senses in the class restricts holistic perception and learning. It also prevents the stimuli other than sight and hearing in educational technology. All the senses should be used as ways to reach the individual in learning. Otherwise, how can stimuli-method variety be ensured in the process of instruction and learning. All these risk the quality in education. Also, although sight and hearing have important roles in perception and learning, the possibility of other senses’ having significant roles in this process can open up new horizons for education.

For years, this information (perhaps statement) has been almost imposed on educators without questioning and doubt: “The influence of sensory organs in the process of learning; sight 83%, hearing 11%, olfaction 3.5%, touch 1.5% and taste 1%” (Ergin, 1998 as cited in Cobun). Is this information true for every culture and period?

Or is it valid for all the ages? If this information was obtained through an experiment or observation as is the case with natural sciences, how many times was the experiment or observation repeated? These questions the number of which can be increased obscure whether the ratios pertaining to learning process-sensory organs should really be understood with quantitative reasoning or not. For example, is 3.5% role of olfactive sense in learning quantitative or qualitative? Is this 3.5 ratio valid for the realms of gastronomy and perfumery? These questions support the suspicion that visual and audio stimuli disabled the other stimuli in the process of instruction and learning after the enlightenment era (Howes, 2002 as cited in Classen, 1993). The experimental studies carried out especially in recent years have shown that olfactive sense may have an effect far more than the 3.5% allocated to it in learning process. Research on olfactive sense has demonstrated that it has significant influence on attention, perception, memory and mood. What is more, it was stated that olfactive stimuli used in learning environment in the context of olfactive sense had positive effects on cognitive performance, creativity, mathematical achievement and writing skill (Tildesley et al., 2005; Ceccarelli et al., 2004; Moss et al., 2002; Sprinkle, 1999). Hudson and Distel (2002) have described olfactive stimuli as cognitive organisers and they have attracted attention to their roles regarding behavioural, physiological and psychological functions. All these point to the fact that sight has limits in learning process and other senses should be involved so as to understand the learning process fully with all its dimensions. In order to acquire alternative perspectives on the implementations in both learning and educational technology, the roles of olfactive stimuli in the processes mentioned will be discussed in this study.

2. Olfactive Stimuli and Learning

The most important output of education process is undoubtedly learning. In order to regard any activity or attempt intended for people as “education”, the process has to end in learning. Currently, complaints are made frequently about the issue that labour and money allocated to education aren’t converted to learning at the same rate. It is undeniable that some of the complaints are concerned with the “transmission losses” in this process. So, these transmission losses should be minimised to increase productivity in education. Although there are a lot of dimensions of the problem of transmission losses in instructional process, the issue is somewhat concerned with extrinsic stimuli, which are intended to stimulate intrinsic processes, which we think lead to learning. It is known that multiple stimuli (rich environments) result in more efficient and permanent learning in this process. However, when the related literature is examined, it can be seen that multiple stimuli are restricted with visual-audio stimuli. Moreover, what is meant by multiple stimuli and rich environments is just visual-audio stimuli. Psychology, philosophy, anthropology and medical data support the idea that these two stimuli play a significant role in learning. However, is it possible to ignore other stimuli in such an important issue even if they have relatively less contribution to the process? Isn’t it a waste of resources to say the least not to take into consideration “the contributions regarded as minor” on the way to obtain a very precious product (learning), which has cost considerable money, labour and effort? The point where the learning environments taking into consideration the variables (stimuli), which are known and considered serious regarding learning have taken us is quite clear. This point, which houses a number of transmission losses is far from being satisfactory.

At the point where it is obvious that what is achieved in education is far from being satisfactory, what is lost by paying attention to alternative ideas that means a paradigm shift in learning process? These alternative perspectives may contribute to the understanding the nature of “learning”, which is fairly complicated. At this point, discovering whether olfactive stimuli are efficient in learning process or not may contribute to the literature in terms of determining the limits (framework) of the phenomenon of learning. Because, learning is not only a phenomenon based on sight and hearing but it is also a multidimensional, complicated process, which interests learners as a whole. This process is a true living. If learning is a living, then doesn’t this living process include sight, hearing, smelling, touching and tasting? Otherwise, basing learning on just sight and hearing is considering that other senses are “dead”.

In this study, the roles of olfactive stimuli as alternative or more precisely complimentary learning variables have been studied departing from the fact that the objectives achieved in learning with variables, which

are known and taken into consideration is not satisfactory. The roles of olfactive stimuli in learning process are handled in different contexts based on the literature. First of all, when the subject is handled in accordance with the existing literature, it is seen that the effect of olfactive sense in learning process is 6% (Küçükahmet, 1998; Rıza, 2003) and 3.5% (Ergin, 1998 as cited in Şahin and Yıldırım 1999) proportionately. The effects of olfactive stimuli in learning process can be classified as pharmacological (interaction with groups such as hormones and enzymes), physiological (stimulant effect) and psychological (Durell, 2004). Some information is found in the literature regarding the effects of olfactive stimuli on learning even though its framework hasn't been drawn clearly for today (Artan, 2003; Given, 1999; Getzels 1974 as cited in Türnüklü, 2000; Johnson, 1990 as cited in Taş, 1996; Akpınar and Ersözülü, 2008). The problem is concerned with not taking into consideration this information and how to utilise this information or how to reflect it in educational technology.

When the roles of olfactive stimuli in learning process are handled in the context of classroom atmosphere, which is an important factor in this process, the following can be said: the data in hand demonstrate that stress resulting from psycho-social and physical conditions of the classroom affects learning negatively; the comfortable and peaceful environments facilitates learning. This case is concerned with the chemistry of learning. During learning, the messages reaching the brain as a result of a complicated process are stored as chemical softwares. The learning capacity of the brain is explained through the relations among neurons and the number of bonds among them rather than its physical structure and number of neurons. When an individual feels well, the brain excretes “endorphin”, which is called as “the chemical of pleasure” and this facilitates the formation of bonds among neurons and paves the way for more bonds. During this process, stress prevents the development of message receptors on brain neurons and restricts the bonds among neurons. This case affects the thinking process, reduces learning and even leads to mental retardation (Özden, 1999; Given, 1999). At this point, olfactive stimuli (Hofmann 1987 as cited in Mccutcheon, 2004), which are known to be influential in this case may help to facilitate learning. Keeping the genetic, personal and cultural characteristics of students in mind, the right olfactive stimuli serving to ease learning can make classrooms more peaceful for students than they are today.

Olfactive stimuli can be studied in the context of making the learning messages meaningful. Research has demonstrated that students don't perceive the messages only but they perceive them with environment properties. Concerning this issue, Özden (1999) points out that we should upload images, sounds and experiences into our brains regarding learning messages. To this end, olfactive images can be used as well as music and images. At this point, olfactive stimuli (aromas) (Donald et al., 2005; Hofmann, 1987 as cited in Mccutcheon, 2004), which are known to be supportive of memory and have effects on the perception of environment in learning process, can be used. The effect of olfactive stimuli in this process results from their ability to manipulate emotions, which are pretty important in attributing meaning to messages. Because, there is close relationship between considering a message attractive or repellent.

Olfactive stimuli can contribute significantly to the cognitive and affective education of normal students and the ones with learning disabilities. In literature, some information is available regarding the roles of olfactive stimuli like controlling emotions and organising long-term memory (Aromafloria 2004, Brosh and Barkai, 2004; Dade et al., 2001). For instance, abstract and difficult concepts can be perceived more easily by matching them with aromas. Moreover, the concepts to be learned can be matched with nice scents and concepts to be avoided with bad ones and thus the efficiency of affective education in classrooms can be increased. When the fact that olfactive stimuli support memory and mental imaging (Herz, 1997; Bodnar et al., 2004) is taken into consideration, olfactive stimuli can be effective in supporting the codification of messages in learning process. Besides, since some olfactive stimuli are quite stimulative, these can be utilised in emergency as life saving association factor (Herz, 1997). Education intends to prepare individuals for life and all phases of life are important. In this case, olfactive sense can have role in preparing individual for life phases in which sight and hearing don't intervene.

3. Olfactive Stimuli and Instructional Technology

Educational technology, in the widest sense, is a bridge between information and learner; instructional technology is to organise (design) human and non-human resources in the classroom in the light of psychological, pedagogical and communication data so as to ensure maximum learning. Instructional technology basically focuses on solving instructional problems. One of the series of implementations that instructional technology applies to reach this aim is message design. The purpose in the design is to produce (fictionalise) the most effective message leading to maximum learning and to transmit it to receivers (intended population) with the most efficient ways possible. It is seen that visual-audio stimuli are employed to a great extent in current practices and other stimuli are neglected when the existing instructional technologies are evaluated from this perspective. If the receiver, learner (human), of instructional technology were composed of only eyes and ears, this application would be enough or true. In fact, instructional technology's sufficing with just visual-audio stimulants is a fortuitous case caused by enlightenment. However, this case, which has an ideological dimension, has by time been adopted as a pedagogical inclination. What is overlooked in this fortuitous case is that other senses including olfaction may have important effects in this process even though the senses of sight and hearing have the dominant effect in perception and learning. Besides, departing from the fact that senses work together, olfactive stimuli may increase the perceiving quality of visual and audio messages. Because, perception and learning are holistic like individual himself.

The holistic nature of learners each of whom are basically "human" consisting of a number of dimensions (body, mind, emotions, and spirit) and sensory organs requires that stimulants to be employed in the process of teaching should be designed so as to address maximum number of sensory organs if not all of them. Because, as a philosopher says, a person has a single sense with five channels rather than five separate senses. The efficiency of these senses in transmitting messages to the brain depends on their supporting each other. Accordingly, it is pointed out that senses of sight and hearing have limits and efficient learning can be achieved through all the senses' working together (Howes, 2002). Hebb (1959, as cited in Özyurt and Girgin, 2000) explains this as "sensory richness helps the organism to form more cell masses and successive phases". Based on this information, olfactive stimuli can play significant roles in augmenting the efficiency of visual-audio messages in teaching process. This role doesn't have to be equal in teaching each discipline or each of the areas of intelligence. For example, olfactive stimuli can play important roles in teaching gastronomy and educating individuals with dominant naturalist intelligence as well as supporting the efficiency of visual-audio stimuli in general.

The basic role of olfactive stimuli in teaching process is not getting ahead of visual-audio messages by playing a major role in sending messages to brain but augmenting the efficiency of these messages. For instance, the efficiency of a visual or audio message employed to teach an abstract subject can be increased by matching it with an appropriate olfactive stimulus selected in accordance with the genetic, individual and cultural characteristics of the learner. Here, the olfactive stimulus, in a sense, helps the visual or audio (or both) message to be coded by brain more efficiently by adding an emotional mode to them. Because, there is a close relationship between cognitive interpretation and emotional mode. In literature, it is stated that olfactive stimuli (aromas) may have important effects on efficiency, speed and permanence of learning by affecting the mood, which has a considerable effect in directing human behaviour (Barocelli et al., 2004; Tildesley et al., 2005; Roberts and Williams 1992 as cited in McCutcheon, 2004; Buchbauer et al., 1991; Van Toller and Dodd, 1988 as cited in Moss et al., 2002). Regarding this subject, Hudson and Distel (2002) describe scents as cognitive organisers.

Supporting visual-audio messages with olfactive stimuli can be done as follows. During the learning process, learner can be directed towards positive information, attitudes and behaviour by matching positive information, attitudes and behaviour to be acquired by the learner with pleasant scents; and undesired information, attitudes and behaviour with unpleasant scents. This matching is directly related with message improvement mission of instructional technology. Besides, the use of olfactive stimuli in learning environment can contribute to make this learning environment more attractive and peaceful. The peaceful learning environment mentioned here can contribute to reduce stress, which is an important barrier to learning. This, in turn, can support coding the messages in learning environment by learners more efficiently.

Attention is one of the most important factors in launching and ensuring learning on which instructional technology focuses. The research on this subject demonstrates that olfactive stimuli have notable effects on attention (Field et al., 2005; Kelvin, 2005; Warm, Denber and Parasuraman 1990 as cited in Köster, 2002; Degel and Köster 1999 as cited in Köster, 2002; Teerling and Köster 1988 as cited in Köster, 2002; Baron 1990 as cited in Köster, 2002; Sprinkle, 1999). The roles of olfactive stimuli on attracting attention can be made use of in teaching process. To this end, various olfactive stimuli can be employed by being arranged in accordance with the principles of instructional technology. For example, at the beginning of the class, the main themes can be presented in company with various scents or class materials can be adorned with different scents. This presentation can be in such a way that pure essence oils can be released to the setting by vaporising or the attraction of various materials can be increased by scenting them. It shouldn't be doubted that various technological applications will be developed in this subject as long as we believe in the importance of olfactive stimuli in educational process. Similarly, olfactive stimuli can be used in increasing concentration, an important variable in learning, and focusing. Because, it is known that olfactive stimuli have positive effects in this subject (Tildesley et al., 2005; Almedia et al., 2004; Barocelli et al., 2004; Moss et al., 2002). One of the reasons of using scents in temples and sanctuaries is this fact. So, olfactive stimuli that are selected in the light of the data of aroma literature and medical data can be released to the classroom setting in different phases of the course or scenting the stationery and class equipment may increase learners' concentration or at least sustain it.

Another very important variable of learning is memory. Memory is the ground of all perception and learning although it isn't emphasized much. This ground can be developed to code stimuli and messages more efficiently and easily. This development has a crucial significance for learning process. Thus, instructional technology, the main aim of which is to provide and develop learning, shouldn't neglect any method or means in supporting memory. Olfactive stimuli can contribute significantly at this point. It is known that aromas have positive effects on memory (Howes and Houghton, 2003; Engen 1991 as cited in Hudson ve Distel, 2002; Finnegan, 2002; Moss et al., 2002; Herz, 1997; Welzl and Stork, 2003; Lamprecht and LeDoux; 2004). Toller (2000 as cited in Köster, 2002) ,as an evidence of memory being supported by scents, has demonstrated that people who lose their olfactive sense have troubles in remembering. Thus, olfactive stimuli can be used in supporting memory. This support provided by olfactive stimuli is fairly important in terms of the permanence of the knowledge learned. This importance is more significant these days on which it is stated that intensive use of technology weakens memory. The use of olfactive stimuli in supporting memory can be in such a way to match the messages with scents, to release scents into the learning environment (for association), or to repeat the class with some scents. However, the use of olfactive stimuli isn't restricted with these applications and different ways of use are needed with the help of research to be carried out in the field of instructional technology.

Conclusion

Olfactive stimuli, which have been pushed out of the realm of perception and learning with the effect of positivism and enlightenment to a great extent, can contribute to the solution of problems regarding learning, the basic study domain of instructional technology. According to the existing literature, the contribution of olfactive stimuli to learning ranges from 3.5% to 6%. Can a proportion of 6% be neglected on the way to obtain a very precious jewel like learning, which is the most important focus of teaching process? Moreover, research demonstrates that this contribution can be more. Besides, focusing solely on visual-audio stimuli in education is in contrast with the contemporary educational notions like "enriching learning environment" and "referring to all domains of intelligence in education". Olfactive stimuli can contribute in preparing the individual for life more holistically by enriching the learning environment and referring to all domains of intelligence.

The contribution of olfactive stimuli to learning is increasing the effects of visual and audio messages or adding some value to them rather than replacing visual and audio messages, which are believed to have dominant roles in learning. Olfactive stimuli can do this by adding emotional mood to visual and audio messages, making them more meaningful and enabling the coding of them more meaningfully. To this end, classrooms can be converted into more peaceful learning environments which are filled with proper scents that are selected keeping

the genetic, personal and cultural characteristics of learners in mind. Thus, learning rate can be increased by reducing stress, which is an important barrier to learning. This increase can be achieved by enhancing the secretion of learning chemicals, which are admitted as the chemical software of learning and help brain cells come together. For this purpose, natural essence oils can be emitted to classroom environment by vaporizing and in proper doses.

Olfactive stimuli can contribute significantly in supporting attention, focusing and memory processes, which are important learning processes. For this purpose, olfactive stimuli selected accordingly (preferably obtained through natural essence oils) can be used by being added to stationery and instructional equipment used in teaching process somehow. Besides, olfactive stimuli can be used in affective learning. So, olfactive stimuli can be arranged in accordance with the principles of instructional technology. For example, learners' acquiring positive attitudes can be supported by matching the desired learning messages (or concepts) with pleasant scents and undesired messages or concepts with unpleasant scents.

Another possible usage area of olfactive stimuli is supporting the learning of individuals with learning disabilities. To this end, olfactive stimuli can be used to support attracting attention, focusing and memory as well as coding the learning messages for learners having learning disabilities. There are applications like "scent garden" in literature concerning this issue.

As the final analysis, olfactive stimuli should be considered as an alternative in addition to the existing processes and applications on the way to ensure maximum learning, which is the basic aim of educational and instructional technology. However, there are a lot of uncertainties on this issue due to the fact that olfactive sense is the least-known sense and there are few studies examining the relation of this sense and education. So, research findings are needed on the nature and use of olfactive stimuli.

References

- Akpınar, B. ve Z. N. Ersözlü (2008). Görme ve Koklama Duyularının Bilişsel Öğrenme Sürecindeki Rollerinin Karşılaştırılması. *GOP Sosyal Bilimler Enstitüsü Sosyal Bilimler Araştırmaları*, (3), 2, 42-53.
- Almedia, R., Simone, C. M., Faturib, C. B., Catallanib, B and Leite, J.R (2004). Anxiolytic-like effects of rose oil inhalation on the elevated plus-maze test in rats, *Pharmacology. Biochemistry and Behavior* 77, 361–364
- Aromafloria (2004). Aroma Communication: First Brain. <http://www.aromafloria.com/FirstBrain.htm>. (Erişim:19.05.2004)
- Artan, İ. (2003). Okulöncesinde fiziksel çevre ve çevre düzenlemesi. *Yaşadıkça Eğitim*, 79: 24-27.
- Barocelli, E., Calcina, F., Chiavarini, M., Impicciatore, M., Bruni, R., Bianchi, A. and Ballabeni V. (2004). Antinociceptive and gastroprotective effects of inhaled and orally administered *Lavandula hybrida* Reverchon bGrossoQ essential oil. *Life Sciences* 76: 213-223.
- Bodnar, A., Corbett, R., Nekrasovski, D. (2004). Aroma: Ambient awaReness through olfaction in a messaging application.<http://www.ece.ubc.ca/elec596/previous/hit2004> (Erişim: 13.04.2004).
- Bodnar, A., Corbett, R., Nekrasovski, D. (2004). Aroma: Ambient awaReness through olfaction in a messaging application.<http://www.ece.ubc.ca/elec596/previous/hit2004>(Erişim: 13.04.2004).
- Brosh, I. and Barkai, E. (2004). Learning-Induced Long-Term Synaptic Modifications in the Olfactory Cortex. *Neurovascular Research*, 1(4): 389-395.
- Ceccarelli, I., William R., Fiorenzani, L.P., Sacerdote, P., Aloisi, A.M. (2004). Effects of long-term exposure of lemon essetial oil odor on behavioral, hormonal and neuronal parameters in male and female rats, *Brain Research* 1001 (2004) 78-86, Elsevier: www.Elsevier.com/locate/brainres
- Dade, L.A., Zatorre, R. J. and Gotman, M.J. (2001), Olfactory learning: convergent findings from lesion and brain imaging studies in humans.

- Donald A. W., Lauriann M. J., Ravi V. S., Clint, A. B. Olfactory Use in Virtual Environment Training. <http://www.modelingandsimulation.org/> Erişim: 03.03.2005)
- Durell, S. (2004). Aromatherapy and massage for people with a learning disability. <http://www.durell842.freemove.co.uk> (Erişim: 20.04. 2004).
- Ergin, A. (1998). *Öğretim Teknolojisi İletişim*. Ankara: Anı Yayıncılık.
- Field, T., Diego, M., Hernandez, R.M., Cisneros, W., Feijo, L., Vera, Y., Gil, K., Grina, D., Claire, H. Q. (2005). Lavender Fragrance Cleansing Gel Effects on Relaxation. *Neuroscience*, 115: 2-16.
- Finnegan, R. (2002) Communicating: The multiple modes of human interconnection. Florence, KY, USA.
- Given, K. B. (1999). Beslenmenin Öğrenmeye Etkisi (Çev: Nilüfer Eyüboğlu). *Yaşadıkça Eğitim*, 63, 37-40.
- Herz, R.S. (1997) . Memory guide. The effects of cue distinctiveness on odor-based context dependent memory. *Memory and Cognition*, 25, 375-380.
- Holden, C. (2004). An Eye for Nose. *Science*, Washington: 303, 621.
- Howes, D. (2002). “Nose-Wise: Olfactory Metaphors in Mind“ Olfaction, Taste and Cognition. Editor: Schaal Benoist. West Nyack, NY, USA: Cambridge University Pres.
- Howes, M. J. R. and Houghton, P. (2003). Plants used in Chinese and Indian traditional medicine for improvement of memory and cognitive function, *Pharmacology, Biochemistry and Behavior* 75, 513-527.
- Hudson, R. and Distel, H. (2002). “The Individual of Odor Perception” Olfaction, Taste and Cognition. Editor: Schaal Benoist. West Nyack, NY, USA: Cambridge University Pres.
- Kelvin, E.Y. L. (2005). Ruminations on smell as a sociocultural phenomenon, *Current Sociology*, 53(3): 397–417.
- Köster, E. P. (2002). “The Specific Characteristics of the Sense of Smell” Olfaction, Taste and Cognition. Editor: chaal Benoist. West Nyack, NY, USA: Cambridge University Pres.
- Küçükahmet, L. (1998). *Öğretim İlke ve Yöntemleri*. İstanbul: Alkım Yayınları
- Lamprecht, R. and LeDoux, J. (2004). Structural Plasticity and Memory. *Nature Reviews*, Volume 5.
- Mccutcheon, L. (2004). <http://www.csicop.org/si/9605/aroma.html> (Erişim: 19.04.2004).
- Moss, M., Cook, J., Wesney, K. and Duckett, P. (2002). Aromas of rosemary and lavender essential oils differentially affect cognition and mood in healthy adults. *Neuroscience*, 113:15-38.
- Özden, Y. (1999). *Öğrenme ve Öğretme*. III. Baskı. Ankara: Pegem A Yayınları.
- Özyurt, S. ve Girgin, N. (2000). *Gelişim Süreçleri-İnsan Nasıl Öğrenir*. Adapazarı: Değişim Yayınları.
- Rıza (2003). Görerek, İşiterek ve Hareket Ederek Öğrenenler- Kim Bunlar? Neden Bunları Tanımalıyız? *Yaşadıkça Eğitim*, Temmuz-Eylül, Sayı:79.
- Sprinkle, R. (1999). The Power of Aroma and Olfactory Experience in the Classroom, Teaching English in the Two-Year Collage, v27 n2 p 188-93 Dec, 1999. ERIC: EJ598874, 2005.
- Şahin, T. Y. Ve Yıldırım, S. (1999). *Öğretim Teknolojileri ve Materyal Geliştirme*. Ankara: Anı Yayıncılık.
- Taş, S. (1996). Okulu Sevdirelim. *Yaşadıkça Eğitim*, 48: 2-5.

- Tildesley, N.T.J., Kennedy, D.O., Perry, E.K., Ballard, C.G., Wesnes, K.A. and Scholey A.B. (2005). Positive modulation of mood and cognitive performance following administration of acute doses of Salvia lavandulaefolia essential oil to healthy young volunteers, *Physiology & Behavior* 83 (2005) 699-709.
- Türnüklü, A. (2000). İlköğretimde Sınıf Düzeni. *Yaşadıkça Eğitim Dergisi*, 65: 36-40.
- Welzl, H. and Stork, O. (2003). Cell Adhesion Molecules: Key Players in Memory Consolidation?, *News Physiol Sci* 18:147-150, 2003.