*Eğitimde Kuram ve Uygulama* *2012, 8 (2):*
*Journal of Theory and Practice in Education* *Articles /Makaleler*
*ISSN: 1304-9496* *http://eku.comu.edu.tr/index/8/2/*

# A CONTENT ANALYSIS STUDY ON EXTRA-CURRICULAR CHEMICAL KNOWLEDGE OF ELEMENTARY LEVEL STUDENTS PROJECTS

(İLKÖĞRETİM DÜZEYİ ÖĞRENCİ PROJELERİNİN KİMYA İLE İLGİLİ MÜFREDAT DIŞI BİLGİLER YÖNÜNDEN İÇERİK ANALİZİ)

**Ramazan ÇEKEN**[1]

## ABSTRACT

Providing proper facilites to the individuals during the process of learning has an important part for practicing the project activities. The student projects competition administered by the Ministry of National Education (MNE) is an interesting example of a Project Based Learning (PBL). These kinds of applications are required for giving sufficient chance to the individuals since they can have more relations with the curricular knowledge than extra-curricular knowledge. The projects carried out in the competition administered by MNE for six years are important at this viewpoit. Extra-curricular knowledge in projects is needed to be convenient with Science and Technology Curriculum (TSTC). For this reason, students and teachers need to be sensetive to select the extra-curricular content. In this study, 389 student science projects ranked in the top 100 during the period of 2006 and 2011 were analsed using a qualitative research method known as *content alysis* to find extra-curricular chemical knowledge. With the evaluation of the data, it is concluded that the extra-curicular chemical knowledge has been used in projects widely. The extra-curricular chemistry knowledge at the high school level is an important problem in terms of the equal opportunities in education and respect for the individual as well. Projects with extra-curricular content help students bring science and real life together if the teachers and parents pay attention to the convenient and inconvenient concepts in the TSTC.

**Keywords:** Project based learning (PBL), elementary science projects, science education, extra-curricular chemical knowledge

## ÖZ

Öğrenme sürecinde proje tipi etkinliklerin gerçekleştirilmesi sırasında bireylere yeterli imkanların sunulması önem taşımaktadır. Milli Eğitim Bakanlığı tarafından düzenlenen ve projelerle öğrenmeyi önceleyen Proje Yarışması, bu bakımdan ilginç bir örnek oluşturmaktadır. Bu tip etkinlikler, program dışından çok program ile bağlantılar taşıması nedeni ile öğrencilere yeterli fırsatların verilmesi açısından gereklidir. Son altı yıldır gerçekleştirilmekte olan projeler bu bakımdan önem taşımaktadır. Projelerde kullanılan program üzeri bilgilerin Fen ve Teknoloji dersi programına uygun olması gerekir. Bu çalışmada 2006 ve 2011 yılları arasında gerçekleştirilen ve yarışmada ilk 100'e giren 389 fen projesinin içeriğinde yer alan program üzeri kimya bilgilerinin içerik analizi gerçekleştirilmiştir. Değerlendirmeler, program üzeri bilgilerin fen projelerinde geniş bir şekilde kullanıldığını ortaya koymaktadır. Program üzerindeki lise düzeyine ait bilgilerin pojelerde yer alması, öğrencilere fırsat eşitliğinin sağlanması açısından önemli bir problem teşkil etmektedir. Öğretmen, anne ve babaların, kavramların Fen ve Teknoloji dersi programına uygun olup-olmamasını dikkate almaları durumunda, program dışı bilgiler içeren projeler, öğrencilerin fen kavramları ile güncel yaşam arasında bağlantı kurmalarına olanak sağlayabilir.

**Anahtar sözcükler:** Proje tabanlı öğrenme, ilköğretim fen projeleri, fen eğitimi, program üstü kimya bilgileri.

[1] Asist Prof. Dr. Department of Primary Teacher Education, Faculty of Education, Sinop University,Turkey. **E-mail:** rceken@gmail.com

## INTRODUCTION

Mental development of individuals occurs in order (Charles, 2003:1). This Piaget's well-known viewpoint leads us to the idea that learning strategies and time period in content of knowledge need to be suitable for individuals' age and ability (Bruner, 2009: 2). This fact identifies the construction process in individulas' mind with the explanation of Piaget's idea for learning which includes that experiences construct the schemes in mind (Bodner, 1986). Thus, meaningful learning occurs in individuals' mental process. Misconception which is a foult of construction process in mind is an important obstacle for meaningful learning. As a result of this construction process of knowledge, schemes including misconceptions have negative effects on learning (Ülgen, 2004: 143).

Misconceptions based on alternatives, mental ability of individuals and preconceptions (Stavy & Tirosh, 2000: 7) are obstacle for the construction process of knowledge. In the meanwhile, insufficient pre-knowledge is another difficulty for this process (Ülgen,2004: 143). Therefore, the nature of construction of knowledge in mind has a close relation to the curricula including the age level and abilities of individuals. Although the knowledge above the level of age and ability of children may be difficult, the easy content may not be in consideration to them. Therefore, the content of knowledge regarding to be difficult or easy content is needed to be included in the curricula.

There is an emphasis on individual learning based on different abilities and levels in TSTC (MEB, 2007a: 22). It gives more importance to social constructivism than the radical viewpoint which is mainly based on subjectivity of knowledge. Multiple intelligence practices in TSTC represent this structure as it involves at least eigth different abilites.

In project practices, the holistic examles of mental, social and radical construction of knowledge require new applications covering the nature of learning clearly and concretely. The projects carried out by the students in a competition were organized by the MNE. This project competition is open to all elementary students from 6 throuhg 8 grades throuhout Turkey. Evaluation system includes some criteria such as originality, social and economic interests (MEB, 2010a: 8).

Even though it is open to all students, evaluation stage does not require objective criteria. It mainly involves an alternative learning strategy known as PBL. Yet, this competition seems to be a behaviorist viewpoint. Besides, the evaluation steps need to include validity and reliability to achieve the main goal of these science projects. Although it aims at giving opportunities to the students taking part in projects actively, projects including extra-curricular knowledge have some difficulties. This is an inevitably interesting debates to how much extra-curricular knowledge need to be located in projects.

The nature of concept and its content are important for curriculum development (Küçükahmet, 2003: 19). This situation is resulted in a process which the projects are not designed by student centered practices. Teachers and parents help children during brainstorming and project practices seem to be the main source of the difficulties in concern.

Extra-curricular knowledge may sometimes support the scientific concepts or subjects, but the knowledge belonging to a higher curricula could be an obstacle for construction in mind. Since TSTC recommend teachers to teach the concepts deep enough by taking care of the age and ability levels of individuals (MEB, 2006a: 66), the general structure of the project knowedge is an obstacle for identifying a suitable practice for curricula. For this reason, authorities give a chance to the students to compete with each other in line with curricular or extra-curricular knowledge which support the learning practices.

In this study, a content analysis of extra-curricular chemical knovledge in science projects were carried out in competitions organized by the MNE. The study mainly pointed out whether or not there is a parallelism between TSTC and extra-curricular chemical knowledge in projects.

## METHODOLOGY

Content analysis is a useful technique to study written documents in general (Lichtman, 2010: 190). The researcher can use this technique to identify the related contents sistematically and/or quantitively. Document content analysis can be used for this purpose as a qualitative design (Bogdan & Biklen, 2007: 44). It involves identifying the purpose, defining the term and analysis unit, grouping the related data, defining the sampling method, categorisation process, reliability and validity steps (Frankel & Wallen, 2006: 482-490).

In this document analysis study, 389 student projects were subjected to content analysis on part of extra-curricular chemical knowledge. The analysing unit is *chemical terms* or *application techniques*. The process of analysis was repeated by two experienced science and technology teachers seperately. The teachers are also advisors in preservice science teacher education. Additionaly, the process of defining terms is repeated in different times by the researcher twice. The final decision of categorisation process was made by the lecturer experienced in science education.

389 science projects were selected by the juri of the MNE. These science projects ranked in the top 100 during the period of 2006 and 2011 have been presented each year in Ankara. At the provincal level, the number of projects submitted each year as follows: 5116 in 2006, 13922 in 2007, 18313 in 2008, 31866 in 2009, 33264 in 2010 and 63247 in 2011. At the regional level, the

number of procets selected each year as follows: 741 in 2006, 959 in 2007, 902 in 2008, 1045 in 2009, 1004 in 2010 and 1048 in 2011.

The submited projects were subjected to selection process firstly in provinces and secondly in regions. The final decision were made in Ankara to find out the top first 100 student projects. 389 science projects were selected by this way. Extra-curricular chemical knowledge among these 389 student projects were identified as the result.

Each project can be reached at the following web page: http://earged.meb.gov.tr/bubenimeserim/. These science projects were listed in order in the last six years as follows: 1-65 in 2006, 66-127 in 2007, 128-190 in 2008, 191-256 in 2009, 257-324 in 2010 and 325-389 in 2011 (MEB, 2006b; MEB, 2007b; MEB, 2008; MEB, 2009; MEB, 2010b; MEB, 2011).

## FINDINGS AND RESULTS

Evaluting the data, extra-curricular chemistry terms or applications were summurised in two groups. The first one is about the *Category of Chemical Substances* and the second one is about *Chemical Applications*. Categoires and projects and their contents are shown in Table-1.

**Table 1. The Extra-Curricular Chemical Kowledge**

| Catgory of Chemicl Substance | | | Category of Chemical Applications | | |
|---|---|---|---|---|---|
| Project Code | Project Topic | Extra-Curricular Terms | Extra-Curricular Applications | Project Topic | Project Code |
| 1 | Ecological Balance | Formaldehyde | Centrifuge | Petrolleum Pollution | 48 |
| 10 | Production of Sugar | Glucose-Sucrose | Ion-centers | Waste water treatment | 57 |
| 27 | Effect of Mobile Phone on Living Things | Ether | Concentration | Eradicating the Parasites | 63 |
| 55 | Protection of Meat | Antioxidants | Centrifuge | Float working with electricity | 86 |
| 56 | Reduction of Sawdust | Copper Carbonate | Autoclave | Pollutant air Heating | 93 |
| 71 | Air and moisture cleaner | Zeolite | ppm | Cleaning the air with huile de cade | 96 |
| 82 | Soda water with molasses | Citric acit | Corrosion | Cleaning the Moisture | 106 |
| 83 | Dental Health | Sweden syrup | Polymer-polystrene-corrosion | Polymer wastes | 146 |
| 84 | Groving water melon | Benzyl amino purine | Hyper-absorbent | Holding water capasity of soil | 165 |

| | | | | | |
|---|---|---|---|---|---|
| 88 | From olive to carbon | Activated carbon | Indicator | Making litmus paper | 167 |
| 104 | Sensor form ilk overfloving | Glycerole | Hydro-gas | Hydrogas in salt water | 190 |
| 144 | Quince seeds cream | Glycerine-vaselin-lanolin | Composite substance | Heat isolation | 214 |
| 206 | Honey Test | Alkaline Copper (II) | Solution | Non-iced | 249 |
| 234 | Groving fast flower | Polyvinyl chloride (PVC)-Perlit | Gravimetric method-corrosion form-5percent NaCl | Making inhibitor | 274 |
| 236 | Automatic lamp | Granit-epoxy-Phosphorix-polyester | Atomic absorbsion-spectrofotometry-oxidation and reduction-Büchner Flask-3,5 Molar 70 milliler $HNO_3$ | Recycling the bateries | 293 |
| 268 | Food safety | Glyserol | Collecting the detergent by the way of rinsing Anionic chlorine form- resin | Recycling of detergent water | 323 |
| 275 | Natural adhesive | Formaldehyde | Termoplastic | Recycling | 336 |
| 348 | Clean Cloth | Acetone-polystyrene molecule | Iodine Titration | Vegetable Preservation | 343 |
| 371 | Organic dyestuffs for cell | Methylene blue | Corrosion | Effect of eggs on corrosion | 358 |
| 376 | Natural adhesive | Toluen | Distillation-fractional distillation | Renewable energy | 360 |
| | | | Concentration | Corn tassel compost | 382 |
| | | Common Projects in both Categories | | | |
| 23 | Automatic irrigation | Polyester | Elastans structure | Automatic irrigation | 23 |
| 31 | Hygienic door handle | IPM-Propylen-glycol-deionized water | Viscosity-IPM | Hygienic door handle | 31 |
| 77 | Producing Natural Colour | isopropyl alcohol | Extraction | Producing Natural Colour | 77 |
| 219 | Nanotechnology- Arsenic | Arsenic-Nanopass Molecule | Metalic melting-nanotechnology | Nanotechnology-Arsenic | 219 |
| 231 | Cutting smooth firewood | PVC | Foam board | Cutting smooth firewood | 231 |

| | | | | | |
|---|---|---|---|---|---|
| 283 | Hygenic Banknote | Agar | Roller | Hygenic Banknote | 283 |
| 292 | From Muck and cocking coal to energy | Hydrogen peroxide | Incubator-milling | From Muck and cocking coal to energy | 292 |
| 347 | Bio-diesel Application | Ethanol, glycerine | Fractional distillation | Bio-diesel Application | 347 |
| 351 | Silkat gel in, Moisture Out | Silikat gel | Higrometer | Silkat gel in, Moisture Out | 351 |

*Category of Chemical Substances*: In this category, *formaldehyde* was used in 1 and 275, *glucose* and *sucrose* were in 10, *polyester* was used in 31 and 144, *IPM* and *propylen* and *glycol* and *deionized water* were used in 31, *antioxidants* were used in 55, *copper carbonate* was in 56, *zeolite* was in 71, *isopropyl alcohol* was in 77, *citric acit* in 82, *Sweden syrup* was in 83, *benzyl amino purine* was in 84, *activated carcon* was in 88, *glycerole* was in 104 and 268, *glycerine* and *vaselin* and *lanolin* were in 144, *alkaline copper (II)* was in 206, *polyvinil chloride* (PVC) was in 231 and 234, *perlit* was in 234, *granite* and *epoxy* and *phosphorix* were in 236, agar was in 283, *hydrogen peroxide* was in 292, *ethanol* and *glycerine* were in 347, *acetone* and *polystyrene molecule* were in 348, *silikat* gel was in 351, *methylene blue* was in 371and *toluen* was in 376.

*Chemical Applications Category*: The terms in this category include chemical methods or concepts or laboratory practices. *Elastans structure* was in 23, *viscosity* was in 31, *centrifuge* was in 48 and 86, *ion centers* and *crystaline structure* was in 57, *concentration* was in 63 and 382, *extraction* was in 77, *autoclave* was in 93, *ppm* was in 96, *corrosion* was in 106 and 146 and 358, *polymer* and *polystrene* were in 146, *solution* was in 249, *hyper absorbant* was in 165, *indicator* was in 167, *hydrogas* in salt water was in 190, *composites* were in 214, *metalic melting* was in 219, *foam board* was in 231, *non-iced* was in 249, *inhibitor* and *Gravimetric method* and *corrosion form* and *5 percent NaCl* were in 274, *incumbator* and *milling* were in 292, *atomic absorbsion* and *spectrofotometry* and *oxidation* and *reduction* and *Büchner Flask* and *3,5 Molar 70 milliliter* $HNO_3$ were in 293, *termoplastic* was in 336, *iodine titration* was in 343, *fractional distillation* was in 347, *higrometer* was was 351, *distillation* and *fractional distillation* were used in 360. The statement located in 323 th Project clearly indicating that students cannot understand the scientific content clearly:

> *"Collecting the detergent by the way of rinsing Anionic chlorine form- resin (MEB, 2010b)."*

This category includes the knowledge combined with organic chemistry directly. Therefore such contents are extra-curricular knowledge as they are required high degree science education to have an easy undertanding. The terms including chemical methods or concepts or laboratory practices such as *formaldehyde, elastans structure, ether, glyserin, propylen, glycol, deionized water, antioxidants, copper carbonate, ion centers, isopropyl alcohol, citric acit, benzyl amino purine, activated carcon, glycerole, lanolin, polymer, polystrene, alkaline copper (II), composites, perlit, epoxy, phosphorix, agar, hydrogen peroxide, ethanol, glycerine, aceton ve polystyrene, silikat gel, methylene blue* and *toluen* are not the main topic in Science and Technology curriculum. They are all the content of chemistry from 9 through 12 grades.

Eventhough the concepts located in Chemical Applications category including the extra-curricular knowledge such as *sucrose* and *solution* and *crystaline structure* and *zeolite* and *Sweden syrup* and *vaselin* and *polyvinil chloride (PVC)* and *granite* and *mosaic* are all related to the real life. The feature of these chemical practices used in projects have a parallel situation with the ability and age levels of elementary grade students. These different part of extra-curricular practices or terms related to the chemistry are not unuseful knowledge at all as they can support the curriculum in concern.

The contents mentioned in chemical application categories such as *elastans structure* and *viskosity* and *centrifuge* and *extraction* and *corrosion* and *sollution* and *hyper absorbant* and *indicator* and *hydrogas* and *metalic melting* and *foam board* and *inhibitor* and *Gravimetric method* and *corrosion form* and *atomic absorbsion* and *spectrofotometry* and *oxidation* and *reduction* and *incumbator* and *autoclave* and *pressing* and *milling* and *IPM* and *nanotechnology* and *composites* and *5 percent Nacl* and *3,5 Molar 70 milliliter* $HNO_3$ and *Büchner Flask* and *ppm* and *ion centers* and *polymer* and *polystren* and *termoplastic* and *iodine titration* and *fractional distillation* and *higrometrer* and *distillation* are not located in TSTC.

With the result of this content analysis study, it is concluded that extra-curricular chemical substances were identified in 29 of 389 projects and extra-curricular chemical applications were located in 30 of 389 projects. 9 of 389 projets include both chemical subtances and chemical applications which are ectra-curricular.

## RESULTS AND DISCUSSION

In these 389 student projects related to the science at elementary level, project participants made their instruments designing models with materials which can be simply found arround the students living area to a large degree. Although this is an effective way of learning, models cannot represent the real world with its complate meaning. Models are required materrials because of visualisation in measurement and calculation (Frek at all, 2003). Analogies

were used in projects as well. As this technique includes the abstract ideas which the students explain easily (Styles, 2003), it is used in this learning process.

Self-confidence and high ability to learn with activities (Ülgen ve Fidan, 2003: 250) are important for PBL practices. They are required for cooperative learning in groups and to design a concrete product during the learning process (Korkmaz ve Çakmakcı, 2006: 110) using models and analogies etc. As 389 student projects have a timing plan and to give priority to the projects related to the daily life problems in line with the ideas of the individuals (MEB, 2010a: 8), they have an important role on the development of the abilities to explain the science and real life using project practices.

We need to give importance to the PBL learning for effective participation of students instead of the behaviorist education such as memorisation, central examinations which are resources of the inadequate evaluating process in Turkish educational system (Erdoğan, Meşeci-Giorgetti ve Çifçili, 2009: 432). The extra-curricular knowledge can be suitable for the students if it supports the ability development of students during the PBL practices. This is a paralel situation with the main purpose of such kind of practices.

## CONCLUSION

Extra-curricular knowledge in relation with evryday life provides to the students to have a deep understanding and to develope the mental abilities. Adding the extra-curricular knowledge which is not suitable for the age level and ability of the students is not convenient with the equality of opportunities in education and in respect to children. Curricula includes objective standards or skills to a large degree at this viewpoint. If we give equal chance to the children, some of them cannot take participate in these kind of learning activities since inadequate facilities such as social and economic standards. The extra-curricular knowledge which is difficult to understand and which is impossible to use in projects without the help of parents is an important limitations and obstacle for the rural areas or low-in come students. We do not need to support this situation by the way of project competitions without taking care of the equality of opportunities in education and in respect to children.

## REFERENCES

Bodner, G. M. (1986). Constructivism: A Theory of Knowledge. *Journal of Chemical Education, 63*(10), 873-877.

Bogdan, R. C. & Biklen, S. K. (2007). *Qualitative Research for Education* (Fifth Edition). Boston: Pearson Education, Inc.

Bruner, J. (2009). Eğitim Süreci (T. Öztürk, Çev.). Ankara: Pegem A Yayıncılık.

Charles, C. M. (2003). Öğretmenler İçin Piaget İlkeleri. (G. Ülgen, Çev.) 4. Baskı. Ankara: Nobel Yayın Dağıtım.

Erdoğan, İ., Meşeci-Giorgetti, F. ve Çifçili, V. (2009). Seviye belirleme sınavlarının bazı değişkenler açısından incelenmesi. 18. Eğitim Bilimleri Kurultayı 1-3 Ekim 2009, İzmir: Ege Üniversitesi.

Frankel, J. R. & Wallen, E. N. (2006). *How to Design and Evaluate Research in Education* (Sixth Edition). Boston: McGraw-Hill Companies.

Frek, V., Vrtacnik, M., *Blejec, A*. & *Gril, A.* (2003). Students' Understanding of Molecular Structure Representations. *International Journal of Science Education, 25*(10), 1227-1245.

Korkmaz, H. ve Çakmakcı, G. (2006). Proje Tabanlı Öğrenme Yaklaşımı. M. Bahar (Ed.), Fen ve Teknoloji Öğretimi (77-135).Ankara: Pegem A Yayıncılık.

Lichtman, M. (2010). *Qualitative Research in Education* (Second Edition). Los Angeles: Sage Publications, Inc.

MEB. (2006a). İlköğretim Altıncı Sınıf Fen ve Teknoloji Dersi Öğretim Programı ve Kılavuzu. Ankara: Devlet Kitapları Müdürlüğü.

MEB. (2006b). İlköğretim Öğrencilerine Yönelik Matematik ve Fen Bilimleri Proje Çalışması. Ankara: MEB Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı. http://earged.meb.gov.tr/bubenimeserim/katalog.html

MEB. (2007a). İlköğretim Altıncı Sınıf Fen ve Teknoloji Dersi Öğretmen Kılavuz Kitabı. Ankara: Pasifik Yayınları.

MEB. (2007b). İlköğretim Öğrencilerine Yönelik Matematik ve Fen Bilimleri Proje Çalışması. Ankara: MEB Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı. http://earged.meb.gov.tr/bubenimeserim/katalog.html

MEB. (2008). İlköğretim Öğrencilerine Yönelik Matematik ve Fen Bilimleri Proje Çalışması. Ankara: MEB Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı. http://earged.meb.gov.tr/bubenimeserim/katalog.html

MEB. (2009). İlköğretim Öğrencilerine Yönelik Matematik ve Fen Bilimleri Proje Çalışması. Ankara: MEB Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı. http://earged.meb.gov.tr/bubenimeserim/katalog.html

MEB. (2010a). V. İlköğretim Öğrencilerine Yönelik Matematik ve Fen Bilimleri Proje Çalışması Başvuru Kılavuzu. Ankara: Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı.

MEB. (2010b). İlköğretim Öğrencilerine Yönelik Matematik ve Fen Bilimleri Proje Çalışması. Ankara: MEB Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı. http://earged.meb.gov.tr/bubenimeserim/katalog.html

MEB. (2011). MEB (2010b). İlköğretim Öğrencilerine Yönelik Matematik ve Fen Bilimleri Proje Çalışması. Ankara: MEB Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı.

Stavy, R. ve Tırosh, D. (2000). How Students (Mis-)Understand Science and Mathematics. New York and London: Colombia University Teachers College Press.

Styles, B. (2003). Analogy-constructive or Confusing? A students' perspective. *School Science Review, 85*(310), 107-116.

Ülgen, G. (2004). Kavram Geliştirme, 4. Baskı. Ankara: Nobel Yayın Dağıtım.

Ülgen, G. ve Fidan, E. (2003). Çocuk Gelişimi, 10. Baskı. İstanbul: Milli Eğitim Basımevi.