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Evaluation of Ceramic Students Awareness Associated with Exposure to Hazardous Materials at the University Level

Bassam N. Al-Radaideh and Ali Huwaishal Al-Shuaili
College of Education, Sultan Qaboos University, Oman

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Corresponding Author:
Bassam N. Al-Radaideh,
College of Education,
Sultan Qaboos University,
Code 123, P.O. Box 32,
Al Khoudh, Muscat, Oman
Tel: 00968-92631371

ABSTRACT
Ceramic supplies contain toxic substance and it produces a wide range of environmental problems and raises a number of public health issues. The hazardous waste produced by ceramicists, in addition to working in a loosely organized area and the lack of research studies that care about student's well-being, all put students' health at risk. Therefore, ceramic students need to take responsibility for their own health at least to the extent they are aware of the problem. The aim of this study is to investigate ceramic student's awareness of hazardous ceramic materials and to determine whether gender or students major has any impact on student's awareness. A questionnaire consists of eleven questions was mailed to 300 students in 5 different universities in the Middle East that have ceramic programs. A total of 255 ceramic students responded to the survey instrument. Information collected from the questionnaire was coded for statistical analysis (SPSS program). The results showed a low awareness among ceramic students regarding the hazardous nature of ceramic material. Also, student's gender and major has no effect on student's awareness. The study pointed to the importance of art-safety courses to become a required part of any art curriculum.

Key words: Ceramic program, students, awareness, toxic materials, safety

INTRODUCTION

Artists and crafts people are workers who create art works or handicrafts for themselves and for people's pleasure. They evolve with the technology available and they adopt modern chemicals and processes for their work. However, art making should not involve toxic substances. Unfortunately, the people who make this entertainment and art possible are regularly exposed to a wide range of the same hazardous and toxic substances that found in industry or in the chemistry department. Rossol (2001) one of the few industrial hygienists specializing in arts safety declare that there is no hazardous chemicals that isn't being used in art department somewhere. According to McCann and Babin (2008), artists and crafts people work with a wide range of harmful materials that includes acids, solvents, metals, pigments, petrochemicals, formaldehyde and much more. These chemicals produce hazardous waste such as toxic and extremely toxic wastes, flammable waste, corrosive waste and reactive wastes. However, artists are less likely to know how to dispose this waste or differentiate between what is hazardous and what is not. Furthermore, the most artists work in a loosely regulated world. The National Institute for Occupational Safety and Health Hazards Evaluation has conducted 4,000 workplace investigations in the last ten years, only two of those requested have been in the arts (Franzblau *et al*., 2008). Artists considered at particularly in high risk, because they are often self-employed and the hazards are hidden due to the benign nature of art. Therefore, very few recognize their danger and their potential for serious and permanent health injuries and illnesses.

The hazards of art materials have been recognized since the early eighteen century, when Bernardo Ramazzini discussed the occupational risks to stone carvers and painters (Fields, 1997). Also, the effects of certain kinds of work upon health have been observed throughout history. In fact, researchers have found evidence that at least some of the old masters were affected by the materials they used to create their

masterpieces. For instance, the painter Francisco de Goya thought to have lead poisoning resulted from the massive use of white and red lead, which left him deaf and crippled. Also, Paul Ruben suffered from the rheumatoid arthritis, while August Renoir and Raoul Dufy both suffered from scleroderma (Priesnitz, 2013).

Priesnitz (2013) the editor of Natural Life Magazine and a former stained glass artisan argues that although the old masters were exposed to a wide range of toxic substances, contemporary artists are in contact with a much wider assortment of materials. She explained that today artists will employ anything in their creation, from commercially produced paints, to discarded household appliances and they will experiment with new and unusual materials to get different effects.

Each art discipline has its own share of hazardous substances. Ceramic or pottery is an especially popular activity for all age groups and it is possible to practice in professional studios, classrooms in public schools, universities and at homes. Ceramic present the potential for serious and permanent illnesses. It can be hazardous during its three processes: working with clay, glazing and firing. Zuskin *et al.* (2007) reported that more than 45 different metals and their many compounds are used in ceramic, in addition to solvents and glazes. These substances includes free silica, asbestos, talc, aluminum, dioxins, lead compound, barium carbonate, cobalt oxide, cobalt carbonate and manganese compounds. Rossol (2001) clarifies that only a small part of these substances have been studied or tested for health effects on human body. Therefore, she considers them hidden hazards that present the potential for a number of public health issues and cause illness or even death if inhaled into the body system. McCann (1998) reported that while making inspections of schools and colleges that adapted the ceramic program and used glazes, found that students and administrators were not aware of the clear coating glaze that they were purchasing and using were actually led glaze. Although many school administrators realize that lead glazes is dangerous, they haven't been successful at making their classroom lead-free. Ceramic materials might enter the potter's body by direct absorption through skin or by inhalation of various gases and vapors when ceramic pieces are fired or by ingestion of clay particles (Franzblau *et al.*, 2008). Whatever the pathway, ceramic making is linked with many illnesses. Complaints of many physical strains like neck and back problems and wrist problems are common among ceramicists, but we are more concerned about serious and sometimes fetal illnesses that result from direct contact with hazardous ceramic materials.

Lead poisoning is the greatest danger that is associated with potters. It results from lead compounds that are found in pottery glaze (Barceloux and Barceloux, 1999). The second most widely recognized ceramic poison is barium carbonate that is present in high concentration in the glaze. Its danger lies in being one of the heavy metals that is difficult to get out of the body once absorbed and its effect is cumulative as lead compounds (Zamek, 2013).

Exposing ceramic or pottery workers to unacceptable dust concentration, through inhalation of silica particles, asbestos, manganese dust and dioxin that are found in clay will target the lungs causing dust related occupational disease such as shortness of breath, respiratory allergies, pneumoconiosis (dusty lung), silicosis, fibrosis and in worse cases lung cancer (Rossol and Bartlett, 1991). A study was carried out by Environmental and Occupational Medicine Department, National Research Center in Egypt to determine the health hazards among ceramics workers. The subjects of 150 male were subjected to clinical examination, plain chest X-ray, ventilator function tests and detection of silica in urine. The results revealed that all respiratory tract symptoms (cough, sputum production, dyspnea and wheezes) were frequent among ceramic workers and there were abnormal changes in chest X-rays and decline in ventilator functions (Aziz *et al.*, 2010).

Most of potters suffer from allergies and as well as dry and chapped skin as a result of working with clay. What's more, breathing toxic fumes such as metal fumes and carbon monoxide that liberate from firing clays and glazes will accumulate in the blood and affect organs such as the lung and the brain, together with manganese compounds that have been linked with a degenerative nervous system disease.

The riskiness of ceramic materials are not only confined to working with them in the studio but in the kitchen as well. For example, leaching is another important issue that results from using ceramic ware in the kitchen. Cooking and storing food in containers that have been made with metals containing pottery glazes cause poisoning and sometimes fatalities. Some glazes are soluble in the presence of certain foods such as orange juice and certain green vegetables, their ingredients maybe released into the food which will result in contamination and therefore leads to major health issues (Dong *et al.*, 2014).

A study was conducted by a group of researchers to evaluate the leaching of heavy metals as lead, cadmium and cobalt from clay-containers into two types of food, tomato sauce and chickpea puree. The results show that the greater use of containers lead to more leaching of heavy metals into both types of food (Valadez-Vega *et al.*, 2011).

Ceramicists regularly utilize a vast array of toxic chemicals that are often not recognized as such. Here lies that problem because most of potters prefer working at home placing and exposing their children and other family members to hazardous substances and conditions. Home studios will increase the chance of eating, touching and breathing art materials. The whole house surfaces will be contaminated with clay dust, free silica, lead that used in glazes and paints and dioxin that is released from the clay during the firing process (Bartel, 2011).

Potters and their families will suffer the effect of over exposures when they live in a contaminated area. As an example, young children might become poisoned while crawling on the floors, rub their hands on these surfaces and put their fingers in their mouths. Maggie MacDonald, the organizations toxics program manager in Canada mentioned

that mothers who were exposed to and ingested chemicals in their environment, showed up in the umbilical cord blood of their babies, which means that their babies will carry toxins in their system at birth (Ubelacker, 2013). What makes the situation worse is that the effect of most toxic materials used in ceramics are not immediately apparent, a potter or a teacher can suffer repeated exposure for years before the appearance of any symptoms. Bartel (2011) contacted a woman who had inhaled clay dust over four years in pottery classes without having any symptoms, but later on she experienced chest pain and after an X-ray and a lung biopsy, she was diagnosed with pneumoconiosis.

In sum, artist and craftspeople are using the same chemicals that are used in industries or in the departments of chemistry, but the handling is entirely different. Knowing what we do today about the hazards of ceramic materials and working of ceramic students in a loosely organized area without monitoring for hazardous materials exposure and without an appropriate and effective protection system, in addition to lack of research studies of the effect of ceramic raw materials on students in colleges offering ceramic; All requires from ceramic students to take responsibility of their own health, at least to the extent they are aware of the problem. Remarkable, spreading awareness is the key for controlling ceramic hazards among this group and it's the first step of the solution.

The specific aim of this study is to investigate the level of awareness of ceramic students to the hazardous nature of ceramic materials and to determine whether gender or major has any impact on student's awareness. The motivation behind this investigation is to generate more interest in the safety issue among ceramic students in particular.

MATERIAL AND METHODS

An 11-item questionnaire was developed to collect data on the student's level of awareness concerning the hazardous ceramic materials (Table 1). The survey instrument validity was examined through a jury panel whereas internal consistency reliability was calculated using Cronbach's alpha coefficient and found to be 81.7.

Table 1: Questions used in the survey instrument

How important do you consider receiving safety orientation and getting reminders throughout the semester about the hazards involved in ceramic activities?
How often do you follow the regulations and safety precaution while working in the ceramic studio?
How often do you use dust masks, gloves, goggles, aprons and local exhaust ventilation system when working with glaze and clay?
To what extent do you feel using the protective equipment provided is important?
How often do you read label information on ceramic supplies that you use?
How often do you store glaze ingredients in closed container?
How often do you eat, drink, or smoke while working in the studio?
How often do you make ceramic at home?
How often do you prepare and mix clay and glaze ingredients, or do sanding or polishing clay items inside the ceramic studio?
How often do you use ceramic kitchen ware for cooking or storing food?
How important do you feel about all the attention being focused on the awareness of hazardous materials in this questionnaire?

Prior to data collection, the directors of ceramic departments were contacted in order to gain access to the institutions that were selected to participate in the study and to request their permission to send the questionnaire to students under their supervision.

The questionnaire was mailed to 300 ceramic students and other students who took ceramic courses from various disciplines of Fine Arts. Five Middle East universities have been involved in this study. The researchers explained to the participants the nature and purpose of the study and described potential benefits of the research. Responses were anonymous and the subjects were assured their information privacy and confidentiality. A total of 255 students responded to the questionnaire (response rate: 85%).

Information collected from the questionnaire was coded for statistical analysis (SPSS Program). Frequency distribution, means, standard deviations and percentages were computed in order to obtain a descriptive analysis of the responses. t-test and ANOVA test were applied to determine if student's awareness will be affected by gender or major. Demographic information were reported to describe the sample.

RESULTS

Table 2 presented the demographic characteristics of the students. To investigate the level of awareness of the hazardous materials among ceramic students, students were asked to answer 11 questions concerning awareness (Table 1). The 11 questions were combined together into one variable called awareness. The scale for the questions was 1 to 4 where 1 indicates not aware and 4 indicate very aware. The codes of questions 7, 8, 9 and 10 were reversed to achieve the same scale of the remaining questions. The results are reported in Table 3.

Table 2: Demographic characteristic of the students

Variables	Frequency	Percentage
Gender		
Male	117	45.9
Female	138	54.1
Total	255	100.0
Major		
Ceramics	122	47.8
Art education	21	8.2
Fine arts	29	11.4
Sculpture	43	16.9
Painting	13	5.1
Design	27	10.6
Total	255	100.0
Smoker		
Yes	133	52.2
No	122	47.8
Total	255	100.0

Table 3: Mean and Standard Deviations for the level of awareness of ceramic students

Parameters	N	Mean	Std. Deviation
Aware	255	2.27	0.297
Valid N	255		

*Scale based on level of awareness: Not ware = 1-1.49, Low awareness = 1.5-2.49, Moderate awareness = 2.50-3.49, High awareness = 3.50-4.00

Table 4: t-test to compare the level of awareness in accordance with gender variable

Gender	N	Mean	Std. Deviation	t	df	Sig.
Male	117	2.29	0.300	0.810	253	0.419
Female	138	2.26	0.295		244.651	

Table 5: ANOVA test to compare the level of awareness in accordance with major variable

Parameters	Sum of squares	df	Mean square	F	Sig.
Between groups	0.474	5	0.095	1.071	0.377
Within groups	22.039	249	0.089		
Total	22.513	254			

Comparison of the means, t-test and ANOVA test were computed for the variable (awareness) to determine whether there was a difference in the awareness level of ceramic students in accordance with gender and major variables. The results are reported in Table 4 and 5.

DISCUSSION

The results in Table 3 show that the students where n = 255 scored a mean of 2.27 and a standard deviation of 0.297. Findings indicate that ceramic students were low aware of the hazardous nature of ceramic materials, since they scored a mean range between 1.50-2.49. This result could be attributed to failure on the part of the teacher in educating ceramic students at the beginning of each semester about proper safety practices in the studio. A woman who had been diagnosed with pneumoconiosis as a result of inhaling clay dust for over 2-4 years in ceramic class, said that their instructor had not cautioned them about the effects of clay dust (Bartel, 2011). Another possible reason for this result is related to student's negligence to safety practices in their working area, because they thin using protection equipment such as gloves and masks will block the creative process. Fields (1997) stated that artists frequently put themselves at risk willingly because they don't hold the same healthy respect for materials as other professionals and because they are excited by the other materials and their potential. There is a popular belief among art students that art can't be harmful. McCann and Babin (2008) give an explanation that art students know that chemicals are dangerous, but the perception is that art materials are not chemicals.

Further data analysis with the t-test and ANOVA test that are reported in Table 4 and 5 showed no significant differences between the mean values concerning the student's awareness of hazardous ceramic materials with respect to gender and major. This means students gender and major has no effect on students awareness, which could be due to that male and female and whatever their specialty, they came from same university background, attend the same courses with the same learning environment.

CONCLUSION AND RECOMMENDATIONS

Despite increased educational efforts and the large number of articles written about the hazards nature of art materials, this study demonstrated a low level of awareness among ceramic students. Based on the results, it's crucial that ceramicists need to make a great leap in their understanding of art safety and they need to take responsibility for their own health while enjoying art, at least to the extent they are aware of the problem.

Awareness is the key for controlling ceramic hazards and it's through educators that the life of ceramic students could be safer by educating more on the subject, spreading more awareness and setting regulations. It is strongly recommended that art-safety courses become a required part of the curriculum of any program that provides instructions in the arts. Also, art students in general and ceramic students in particular need to follow health instruction without having someone enforcing the roles. Besides, more attention should be given to art community for hazardous materials exposure. It's highly recommended that all art programs subject to inspection by certified industrial hygienists to recognize the techniques, tools and materials used by the artists.

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REFERENCES

Aziz, H.M., S.B. Ahmed and I.A. Saleh, 2010. Respiratory hazards among Egyptian ceramics workers. Researcher, 2: 65-73.

Barceloux, D.G. and D. Barceloux, 1999. Cobalt. Clin. Toxicol., 37: 201-216.

Bartel, M., 2011. Hazards in ceramics. https://www.goshen.edu/art/DeptPgs/Hazards.html

Dong, Z., L. Lu, Z. Liu, Y. Tang and J. Wang, 2014. Migration of toxic metals from ceramic food packaging materials into acid food simulants. Math. Prob. Eng. 10.1155/2014/759018

Fields, S., 1997. Exposing ourselves to art. Environ. Health Perspect., 105: 284-289.

Franzblau, A., E. Hedgeman, Q. Chen, S.Y. Lee and P. Adriaens *et al.*, 2008. Case report: Human exposure to dioxins from clay. Environ. Health Perspect., 116: 238-242.

McCann, M., 1998. Entertainment and the Arts. In: Encyclopaedia of Occupational Health and Safety, Volume 3, Stellman, J.M. (Eds.). 4th Edn., Chapter 96, International Labour Organization, Geneva, Switzerland, ISBN-13: 9789221098164, pp: 2-28.

Mc Cann, M. and A. Babin, 2008. Health Hazards Manual for Artists. 6th Edn., Lyons Press, Guilford, USA., ISBN-13: 978-1599213187, Pages: 176.

Priesnitz, W., 2013. Art and art making can be toxic to your health and the environment. Natural Life Magazine. http://www.life.ca/naturallife/0410/artmaterials.htm.

Rossol, M. and B. Bartlett, 1991. Danger, Artists at Work: A Guide to Occupational Hazards and Precautions for Australian Arts Workers and Teachers. Thorpe-Bowker, Port Melbourne, Victoria, Australia, ISBN-13: 9780909532987, Pages: 215.

Rossol, M., 2001. The Artist's Complete Health and Safety Guide. 3rd Edn., Allworth Press, New York, USA., ISBN-13: 9781581152043, Pages: 405.

Ubelacker, S., 2013. Toxic chemicals found in newborns: Report. The Globe and Mail Inc., Toronto, ON., Canada, June 26, 2013.

Valadez-Vega, C., C. Zuniga-Perez, S. Quintanar-Gomez, J.A. Morales-Gonzalez and E. Madrigal-Santillan *et al*., 2011. Lead, cadmium and cobalt (Pb, Cd and Co) leaching of glass-clay containers by pH effect of food. Int. J. Mol. Sci., 12: 2336-2350.

Zamek, J., 2013. Studio: Studio safety part 1. J. Aust. Ceram., 52: 85-89.

Zuskin, E., E.N. Schachter, J. Mustajbegovic, J. Pucarin-Cvetkovic and J. Lipozencic, 2007. Occupational health hazards of artists. Acta Dermatovenerologica Croatica, 15: 167-177.