

ARCHITECTURAL INFLUENCE ON THE INTELLIGENCE AND CREATIVITY OF CHILDREN

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ABSTRACT

The main objective of this research is to study the concepts of creativity and intelligence, causes and roots of nurturing a creative and intelligent person, and to offer solutions for the architectural space of kindergartens in order to promote the children's intelligence and creativity. This study is a descriptive-correlative research. We have used the random cluster sampling method. The sample includes 60 trainers of Bandar Abbas kindergartens. Due to the lack of any standard related questionnaire, we have used a research-made questionnaire. We analyzed the data at two levels of descriptive and inferential statistics. At descriptive level we used statistical indexes such as the mean and frequency; and at the inferential level we relied on step-by-step regression and Pearson correlation test. Findings of the research show the trainers believe that the most important factor in increasing the creativity is the stimulation by natural elements. Descriptive results include architectural ideas.

Keywords: *Architecture, Creativity, Intelligence*

1 - Introduction

Children are born curious and they deeply test and identify their surrounding environment. Their discoveries from the surrounding environment remains deeper in their mind than what their parents teach them every day. Such discoveries are even more effective and more desirable than what they learn from the entertaining picture books. This is why the first experiences of the children are extremely important in this regard.

The environments with richer experimental facilities motivate the innovation and creativity of the children. Diverse environments, specifically the external environments are more potential for power of discovery and creativity. They are more open to create the social scenarios in the children's mind. On the other hand, designing is indeed walking along nurture and skill acquirement; along a magical respect, imaginary plays, among the security and creative exciting challenges in places where help the children to grow. The children need safe places as well as challenges for their growth (Day, 2007: 3). The nurture of many human abilities begins in childhood. Childhood is the period of the nurture of imagination and creativity. According to Freud, the creativity roots in the childhood (Shariatmadari, 1965: 410). Thus it is quite important to pay attention to the nurture of creativity in childhood.

1.1 Creativity

Creativity is derived from the verb *to create*. Creativity is one of the characteristics of the human thought and undoubtedly, it is one of the most important goals of the education (seif, 2001: 213).

1.2 Environmental motivation of the creativity

Environmental motivation includes all external factors that motivate the behaviors of the living creatures. The environment includes the geographical environment, physical environment, social

environment, cultural environment, etc. (Shafaei, 2009: 91). There is a rich literature on the effects of environment on the creativity but the effects of physical environment and its factors on the creativity of children have been mainly ignored and the available literature lacks the studies on this subject. All physical factors such as the light, sound, landscape, sound pollution, etc. can have positive or negative effect on the level of creativity. Color, fabric, light-darks, light, form and their combinations, space uses and their changes and diversities during the time, and all corners of the built space can have an effect on the physical, cognitive or mental aspects of human and can cause the needed motivation for the creative thinking (Christiansen, 2004: 89).

Some environmental factors that play the role of promoting the creativity are as follow:

- a) Natural factors of environment: creating a natural landscape of the environment that is affective in the growth of creativity. According to Shibatana and Suzuki, the existence of the plants in educational spaces has the stimulating effect on the process of creativity (McCoy and Evans, 2002: 419).
- b) Materials: the use of natural materials and avoiding the use of superficial materials with combinational level of them leads to the promotion of the creativity (McCoy and Evans, 2002: 420).
- c) Color: light colors and the use of coordinated colors for creating a light space are effective on the growth of the creativity. Many researchers believe that the use of desirable colorful and exciting pictures can be the main motivation for all creativities (Shafaei, 2009: 116).
- d) Shape and extent of the spaces: the shape and size of the spaces can cause the gathering of people and groups who gather for social relationships and interactions. The social interaction theory states that the level and type of the collective communications is positively effective on the process of creativity. Thus if the space design (in terms of the shape, size and performance) increases the level of communications and if it has a positive effect on the quality of these interactions it can affect the growth of creativity.
- e) Aesthetic factors: the available literature shows that the increase of aesthetic elements in the building of the schools will increase the students' achievements. The architecture of the school is effective on facilitating the transfer of cultural values; it can be motivating or deterrent; it is effective in decrease or increase of the process of creativity and mental cognition of the students; and even it can cause fear or happiness in the students (Shafaei, 2009: 118).
- f) Decorations: researches show that the complexity of the visual details is effective on the promotion of the creativity. The use of the works of both the prominent artists and the children themselves in the decoration of the space and creating a space that make it possible to suspend the works to other days can be positively effective in the process of the children's creativity. Most researches have shown that the children whose environment is monotonous cannot exploit their cognitive abilities.

1.3 Intelligence

In the simplest and intelligible words, intelligence is defined as the "ability of adaptation to the environment"; and adaptation to the environment means the ability to think, realize and understand the problems and needs. All organisms can adapt themselves with their surrounding environment in order to survive. Whenever they get hungry, they look for the needed food. Whenever they are threatened, they know how to defend themselves. In sum, whenever they need something, they find ways and solutions to meet their needs. All living things on the earth have two independent but closed intelligences to be used at the proper time (Raouf, 2010: 97):

- a) Intelligence quotient (IQ)
- b) Emotional quotient (EQ).

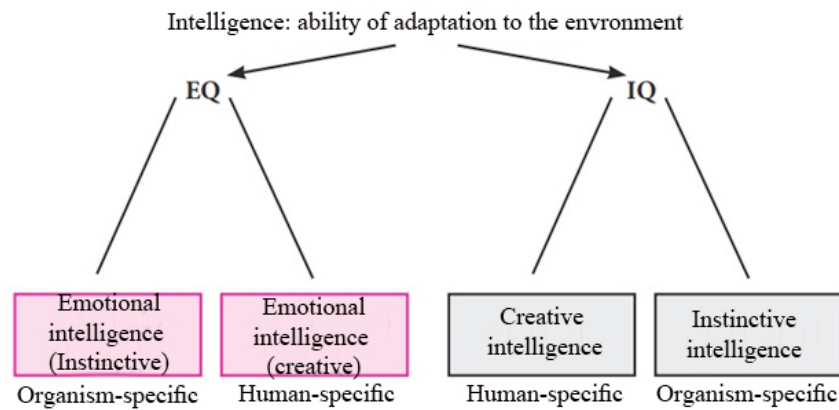


Fig. 1. Intelligence analysis (source: Raouf, 2010)

1.4 Relationship between IQ and creativity

In studying the growth of creativity in children at lower ages, it is necessary to know some important and basic information. The creativity sometimes comes with other gifts and hence it is necessary to differentiate the creativity, intelligence and talent. If we accept the fact that the creativity is a cognitive process, then we can conclude that higher levels of creativity are related to higher levels of intelligence. Although for showing the level of creativity we have to refer to the level of intelligence, but some quite intelligence persons are not creative at all. Experts of creativity believe that the creativity and intelligence are two completely different qualities. Everybody has more or less creativity. Creativity is as natural for a middle-talented person as it is natural for a genius (Gerivez, et al. 2000: 54).

1.5 Effective factors on the function of brain cells

Although the brain of a mature human being forms only 2% of his weight, it consumes 20% of the physical energy of the man. The brain energy is supplied by an oxygen-full blood. The needed oxygen is supplied through the lungs. The brain of human needs the circulation of 8 gallons of blood in each hour. The suitable electronical balance for the brain function is obtained by the water of the body; and to catch such a balance, everybody must drink 6 to 12 glasses of water daily. The loss of the body water at the time the students' presence in classroom is a main cause of learning damages, laziness and lethargy. This is while the water taps are located outside the classrooms and the students rarely access to the water taps during the class hours (Hannaford, 1995).

Another critical factor for the desirable function of the brain is oxygen. Without the fresh air we cannot expect the optimal function of the brain. Hence the design of the school building and supply of the school equipment and facilities have to supply the fresh air for the classrooms (Jensen, 1998). Visual and practical learning make the brain of the learner create stronger and newer communications. Music, architecture, painting and other arts are very effective for learning. The architecture and the façade of the schools that have been designed suitably are stimulating from the aesthetic point of view. Such school environments are related to the growth of the brain and make the brain works more actively (Chen and Petrich, 1998).

Ford believes that the motion activities get possible by the neural connections of the whole body. Motion makes the body be a learning instrument. If you consider the brain as a muscle, then you can find out that one of the best ways to maximize the capabilities of the brain is motion and exercise. Exercise makes the physical motion of the brain ready for desirable learning (Brauninger, 2012).

The children move through several paths and all their movements are forms of communication. The children often learn about the surrounding world through their own experiences. Harmonized movements involve the children in discovering themselves, their environment and the others. The goal of each harmonized movement is to conduct the child toward the fulfilment of personal goals, causing the evolution in their awareness, interaction and group adaptation. In case of the mutual relationship

between the intelligence and the body or body movements, although the learning tasks will be ultimately replaced in the brain, but such tasks are usually forgotten while the body receives sensory information from the environment (Coddard Blythe, 2009).

The conducted researches on the brain show that the scale and type of the color is effective on learning. Warm colors and bright lights increases the muscle cramps, breathe rate, heart rate, heart pressure and brain activities. Insufficient light causes the eye fatigue. Heterogeneous color combination of the environment can cause the decrease of the reactions and disrupts the works. Suitable lights and colors lead to the improvement of the visual processing of information and reduce the mental pressures (Baron, 1992).

The available literature confirms that a suitable learning space must have desirable temperature and lack any annoying noises. The reception of destructive sounds by the brain interrupts the function of cerebellum that is the main processor of the brain (Petrich and Chan, 1998).

One of the critical mistakes of the human is to underestimate and neglect toward the infants and children. Many works can be suspended for future, but we cannot suspend the issues of the children because their bones, their mind and their soul are growing every moment. Accordingly, we cannot suspend the fulfilment of the children's needs and requirements to the future.

This article attempts to study the effects of four factors (i.e. the design of internal spaces, flexibility of performances, natural elements, and color and lighting) on the creativity.

2 Methodology of the research

The statistical population of this research includes all -6 years old children of Bandar Abbas. Due to their specific perceptual and verbal characteristics, the mentioned children were studied through attitude measurement of the trainers and assistants of the kindergartens. Thus 60 trainers and assistants were selected through the random cluster sampling method to measure their attitudes. Due to the lack of any standard questionnaire in this area we have used a research-made questionnaire. After determining the reliability and validity of our data collection instrument, we analyzed the data at two levels of descriptive and inferential statistics. At descriptive level we used statistical indexes such as the mean, standard deviation and frequency; and at the inferential level we relied on step-by-step regression and Pearson correlation test.

2.1 Measurement instrument

Instrument: we designed a questionnaire to measure the attitude of the assistants and trainers of the children on four factors: design of internal spaces, flexibility of performances, natural elements, and color and lighting. The questionnaire was designed in some different steps:

- 1) First the questionnaire was designed based on the research hypotheses and the effect of four mentioned factors on the hypotheses.
- 2) The questionnaire had 26 questions based on Likert scale.
- 3) To assure the clarity of the questionnaire, we tested it on a small group of kindergarten trainers (including 5 subjects). In this regard, we asked them to read the questions one by one and to explain the intention of each questions. 8 questions were removed in this step.
- 4) After testing the validity of the questions, the final questionnaire was adjusted with 18 questions and its validity and reliability was tested and confirmed.
- 5) Variables:
 - a. Design of internal spaces (DIS): questions 1 to 7.
This variable deals with the questions about the relationship of the DIS and creativity and intelligence such as the design of corners in playing spaces, use of curved walls with unusual designs, design of the motion spaces of the kindergarten, design of opening spaces, etc.
 - b. Flexibility of performances (FP): questions 8 to 11.

By the flexibility of performances we mean that a space can have different uses with least changes, based on the needs of space, such as the use of divider walls, combination of two or some spaces, etc. Thus a single space can be used for different performances.

- c. Natural elements (NE): questions 12 to 15.

This variable refers to the use of natural elements within the space of kindergarten, such as the use of natural plants that produce colorful leaves in different seasons or even the possibility of keeping some animals that are parts of the nature.

- d. Color and lighting (CL): questions 16 to 18.

The use of the colors (such as red and orange) that stimulate the brain cells, or use of different colors and fabrics in the walls or the play of lights by the colored glasses, and so on

3 Findings of the research

In testing the validity and reliability of the questionnaire on 60 respondents, the Cronbach's alpha and split-half reliability was obtained as 0.98 and 0.92 respectively. The questions were designed in 5-item to be completed as the self-tested instrument. The answered ranged from "very high" to "very low" so that the respondents could mark one of the answers and choose one item among the "very high", "high", "normal", "low" and "very low". The answers were scored 0 to 4.

To calculate the correlation and internal stability of the descriptive index of the kindergarten space we used Cronbach's alpha and the following results were obtained: DIS: 0.08; FP: 0.89; NE: 0.9 and CL: 0.9.

3.1 Descriptive findings

Table 1 shows the correlation matrix of the descriptive findings of research.

Table 1. Frequency distribution of the sample

Sample	Frequency	%
Trainers and assistants	60	100

Source: authors

As the table 1 shows, the number of the assistants and trainers equals to 60 subjects with frequency percent of 100%.

Table 2. descriptive statistics of the respondents in terms of work experience

Work experience	Frequency	%
Less than 10 years	18	30
More than 10 years	42	70
Total	60	100

Source: authors

As the table 2 shows, 18 respondents (30%) have had less than 10 years of work experience while 42 respondents (70%) have had more than 10 years of work experience.

Table 3 shows the descriptive statistics of the research variables (i.e. the design of internal spaces, flexibility of performances, natural elements, and color and lighting).

Table 3. descriptive statistics of the variables

Variable	Mean	Std. Deviation	Questions on creativity	Questions on intelligence	No.

DIS	23.68	4.84	4	3	7
FP	26.13	3.82	4	0	4
NE	29.84	5.6	4	0	4
CL	31.97	6.57	2	1	3

Source: authors

As the table 3 shows, the mean of scores for DIS, FP, NE and CI equal to 26.68, 26.13, 29.84 and 31.97 respectively and the standard deviation for the mentioned variables equals to 4.84, 3.82, 5.6 and 6.57 respectively.

3.2 Inferential findings

3.2.1 Analysis of the research questions

In order to analyze the research questions we used Pearson correlation test whose results are shown in relevant tables.

3.2.2 Research questions

How we can increase the intelligence and creativity of children by the design of physical environment of the kindergarten?

In order to identify the relationship between the elements of the design of internal spaces, flexibility of performances, natural elements, color and lighting, and the child's imagination we used some questions that explicitly refer to the increase of the creativity and sense of curiosity in children. Moreover, in order to express the dependence or independence of the correlation of the effects of variables, we used Pearson correlation test whose results are shown in table 4.

Table 4. correlation matrix for the relationship between design factors and creative reactions of children

	DIS	FP	NE	CL
DIS	1	-0.40	-0.332*	- 0.228**
FP		1	0.246**	0.75
NE			1	0.348**
CL				1

* Significance level: 0.1

** Significance level: 0.5

Source: authors

As the table 4 shows, there is a positive significant relationship between FP and NE at significance level of 0.5 and there is a positive significant relationship between CL and NE at significance level of 0.5.

3.3. Analyzing the hypotheses of the research

This research had 4 hypotheses as follow.

Hypothesis 1: It seems that the interference between the open and closed spaces can stimulate the children's imagination and motivate their creative reactions.

Table 5. descriptive statistics for DIS and factors of creativity and intelligence

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		Creativity	Intelligence
Interference of open space	Pearson's correlation	0.874	-0.275
	Sig. (2-tailed)	**	**
	Sample size	60	60
Interference of closed space	Pearson's correlation	0.730	0.315
	Sig. (2-tailed)	**	**
	Sample size	60	60

** Significance level: 0.5

Source: authors

The obtained correlation coefficient between the two variables of the interference of open space and creativity equals to $r = 0.874$ that is significant at $p < 0.5$ (2-tailed). The positive correlation shows that the increase of the design of open spaces increases the children's creativity, vice versa. The effect of open spaces in the kindergartens is higher than the use of closed spaces.

Hypothesis 2: the creation of inflexible spaces that can be changed by the children themselves leads to the increase of their imagination and curiosity.

Table 6. descriptive statistics for FP and creativity

		Creativity
Combination of spaces	Pearson's correlation	0.650
	Sig. (2-tailed)	**
	Sample size	60
Changeable space	Pearson's correlation	0.543
	Sig. (2-tailed)	**
	Sample size	60

** Significance level: 0.5

Source: authors

The obtained correlation coefficient between the two variables of the "combination of spaces" and "creativity" equals to $r = 0.65$ that is significant at $p < 0.5$ (2-tailed). The positive correlation shows that the increase of combination of spaces increases the children's creativity, vice versa.

Hypothesis 3: the use of accessible natural elements (i.e. water, soil, wind) increases the creativity of children.

Table 7. descriptive statistics for NE and creativity

		Creativity
Natural elements (water, soil, plants, animals, etc.)	Pearson's correlation	0.456
	Sig. (2-tailed)	**
	Sample size	60

** Significance level: 0.5

Source: authors

The obtained correlation coefficient between the two variables equals to $r = 0.456$ that is significant at $p < 0.5$ (2-tailed). The positive correlation shows that the increase of the use of natural elements in the environment increases the children's creativity, vice versa. But the low value of the obtained correlation coefficient suggests that the effect of this factor is negligible in the design of the kindergarten spaces.

Hypothesis 4: color and lighting has an explanatory role in the increase of the children's creativity and intelligence.

In order to predict the contribution of this factor for using in the design of kindergarten we used regression model for data analysis whose results is shown in table 8.

Table 8. results of step-by-step regression for CL variable on the

increase of creativity and intelligence

Step	Variable	B	R	R2	T	Std. error
1	CL		0.86	0.7396	-3.7	0.45

* p<0.1

Source: authors

As the table 8 shows, in the step 1 the CL variable was inserted into the regression equation. This variable explains 0.7396% of the variance of the increase of creativity and intelligence ($r=0.86$). This value is statistically significant and it has considerable effect on the design of the spaces for increasing the creativity and intelligence of the children.

4 Conclusion and discussion

4.1 Relationship between the variables

As the table 4 showed, there is a positive significant relationship between FP and NE at significance level of 0.5 and there is a positive significant relationship between CL and NE at significance level of 0.5.

4.2 The effect of variables on creativity and intelligence

Based on this research we can describe the effect of the research variables on creativity and intelligence as follow:

- 1) The design of internal spaces is effective on the creativity and intelligence. The obtained correlation coefficient between the two variables of the interference of open space and creativity equals to $r= 0.874$ that is significant at $p<0.5$ (2-tailed). The positive correlation shows that the increase of the design of open spaces increases the children's creativity, vice versa. The effect of open spaces in the kindergartens is higher than the use of closed spaces.
- 2) Flexibility of performances is effective on the creativity.
The obtained correlation coefficient between the two variables of the "combination of spaces" and "creativity" equals to $r= 0.65$ that is significant at $p<0.5$ (2-tailed). The positive correlation shows that the increase of combination of spaces increases the children's creativity, vice versa.
In order to make the spaces flexible at different time based on the educational schedules we can divide each space into several needed spaces by moving partitions in accordance to our needed performances. This characteristic is indeed the changeability of space and its components. This characteristic depends on the innovativeness because if the divided spaces are boring and repetitious, then they won't attract the children. Hence we can design the spaces in a way that the changes are new and interesting (Shafaei, 2009: 56).
Imagination is a very effective factor on the process of creativity (Kreapner, 1999: 597-606). The changeable spaces increase the imagination of the children, while imagination is one of the indicators of creativity and the child can change the space based on his/her own imagination.
- 3) The use of natural elements is effective on the creativity.
The obtained correlation coefficient between the two variables equals to $r= 0.456$ that is significant at $p<0.5$ (2-tailed). The positive correlation shows that the increase of the use of natural elements in the environment increases the children's creativity, vice versa. But the low value of the obtained correlation coefficient suggests that the effect of this factor is negligible in the design of the kindergarten spaces.

The human is interested in nature instinctively. Many human dreams are associations of the mental images about the nature (such as the dreams of fly by seeing the bird's fly) because the imagination is the positive force of the mental images (Sheikholeslami, 2009). Since the natural elements can emerge in different shapes and colors at different situations, their presence in the childish spaces stimulates the children's imagination. Moreover, the children love to play with the water, soil and sand. Such games motivate their imagination; and the imagination is an important step toward the creativity.

- 4) Color and lighting plays a determining role in the increase of creativity and intelligence. As the table 8 shows, in the step 1 the CL variable was inserted into the regression equation. This variable explains 0.7396% of the variance of the increase of creativity and intelligence ($r=0.86$). This value is statistically significant and it has considerable effect on the design of the spaces for increasing the creativity and intelligence of the children. The use of the colors such as red and orange in the walls of the educational classrooms promotes the concentration of the children and stimulates their brain cells. Suitable lighting in the educational spaces must not be so shiny that makes the eyes tired. The use of artificial lights instead of the natural lights, and the use of light games by the colorful glasses and creating dark-lights in the kindergarten space make the space dreamy and promote the imagination of children and increase their creativity.

4.3 Limitation of the research

Along its achievements, every research faces several limitations. Some of the limitations of this research are as follow:

- 1) Gender of the children: in the kindergarten there are both boys and girls. If they are studies separately, probably the results of the attitude measurement of the trainers would be changed in terms of the creativity and intelligence of the children.
- 2) This research is based on the scientific researches that mentioned in the literature review and on the opinions of the trainers. It is probable that the trainers have answered the questions carelessly and impatiently and hence the answers may not reflect the exact opinion of the respondents.
- 3) Several factors can play role in increasing the creativity and intelligence of the children such as the heredity, personal characteristics of the children, educational technics, etc. while it was not possible to approach all of them in this research.
- 4) One of the characteristics of the architecture is the structural system of it, but due to some reasons such as the time limitation, economic limitations, etc. we were not able to study all of them.

4.2 Suggestions

- 1) Conducting the same researches in schools and higher grades and even the universities for promoting the intelligence and creativity of school and university students.
- 2) Conducting the researches in terms of the gender separation for studying the effects of architectural space on the factors of creativity and intelligence

REFERENCES

- Barron, F. (1963), *Creativity and psychological health*. Princeton, NJ: Van Nostrand
- Brauninger I. The efficacy of dance movement therapy group in improvement of quality of live: A randomizedcontrolled trial. *Art Psychother.*2012;39(4):296-303.
- Chan T.C and Petrie G.F (1998), The brain learns better in well-school environment classroom leadership Online.Vol.2 No.3.
- Christopher Day, Anita Midbjer,(2007) Environment and children, Architectural Press.
- Dekhoda, Ali Akbar (1995), *Persian Encyclopedia*, Vol. 21 [in Persian].

- Eysence, H.J (1995). *Genius: The natural history of creativity*. Cambridge: Cambridge University Press
- Goddard Blythe S. Attention (2009), balance and coordination the *A.B.C. of learning success*. New York: Wiley Blackwell Published.
- Greves, Gargilo Slader (2000), *Creativity: Understanding the Children's Characteristics and the Ways of Confrontation*, translated by Mehdi Qarachedaqi, Tehran [in Persian].
- Hannaford, C. (1995). *Smart Moves*. Arlington, VA: Great Ocean Publishing Co
- Jensen, E. (1998). *Teaching with the brain in mind*. Alexandria, VA: ASCD
- Kristensen T. (2004), The physical of creativity, *Creativity and Innovation Management* Vol 13 No 2 P 89m
- Mc Coy M.& Evans, J. & Gray, W .(2002). The Potential Role of the Physical Environment in Fostering Creativity. *Creativity Research Journal*, Vol 14, No .3, 4.Pp.409-426
- Johnson, A. B. & Tsang, C. D. (2010). Chapter name in an edited book. In K. L. Lee (Ed.), *Understanding Student Engagement* (pp. 234–256). Hong Kong: Longman.
- Leung, E. F. (2012). *Online Learning*. Singapore: Pearson.
- Raouf, Ali (2010) “What is intelligence?”, *Journal of Efficient Informing*, No. 8, pp. 97-99 [in Persian].
- Saeida Ardakani, Saeid (2008), “The role of emotional intelligence in the creativity and innovation”, *Proceedings of the First National Conference on Engineering Creativity and Innovative Management in Iran and the First National Conference of Thinking and Science-Fiction Works*, pp. 3-8 [in Persian].
- Seif, Ali Akbar (2004), *Pedagogical Psychology*, Tehran [in Persian].
- Shariatmadari, Ali (1965), *Educational Psychology*, Isfahan: Mashal [in Persian].
- Shafahi, Minoos (2009), *Ideas for Designing the Kindergarten for Promoting the Children's creativity in Iran*, PhD Thesis, Architecture and Urban Planning Faculty, Iran Science and Industry University [in Persian].
- Wong, G. H. and Yuen, I. J. (2011). Open educational resources: Opportunities and threats. *Journal of First Class Online Learning*. 18(2), 128–138.