ISSN 2229-5518

THE EFFECT OF ATMOSPHERIC OPTICAL PHENOMENA PHOTOGRAPHED BY STUDENTS ON LEARNING MOTIVATION

D. BLIZAK, S. REMLI, S. BLIZAK

Abstract—The atmospheric optical phenomena (mirages, rainbows, halos, blue sky, sunset …) that we can observe in everyday life are very interesting for stimulating the students' curiosity. This study aimed to investigate the effect of atmospheric optical phenomena photographed by university students' on their learning motivation in geometrical optics (GO). To achieve the aim of the study, an available sample of the study composed of (200) students from the biology department of Boumerdes University, Algeria, was used. The subjects were randomly distributed into two groups: (165) of them in the experimental group and (35) in the control group. We have asked every student in the experimental group to use their smartphone or tablet to taking photos of an atmospheric optical phenomena and giving a physical explain. According to the motivation post and pres test, there were statistical significant differences in learning motivation in the favor of the experimental group.

Index Terms— Atmospheric optical phenomena, motivation, geometrical optics.

1 INTRODUCTION

With the revolutions brought by Information and Communication Technologies (ICT) in recent decades, we are in the middle of a digital world. The teacher is no longer the only source of information. His new mission is to develop and manage teaching strategies in order to make his course interesting. He must use all possible means to motivate the students because motivation pushes learners to practice cognitive, emotional and dynamic activities.

- *Assoc. Prof. Dr D. BLIZAK Université M'hamed Bougara de Boumerdes, Algérie, E-mail: d.blizak@univ-boumerdes.dz*
- *Asst. Prof S. REMLI Université M'hamed Bougara de Boumerdes, Algérie,*
- *Assoc. Prof. Dr S. BLIZAK Université M'hamed Bougara de Boumerdes, Algérie*

Motivation to learn is defined by Brophy (1983) as the learner's tendency to look for meaningful activities for him. As well, Viau (1994) states that motivation is a dynamic state that has its origins in the student perceptions of himself and his environment and the incentive to choose an activity, engage and persevere in his accomplishment to achieve a goal. According to the self-determination theory (Deci & Ryan, 2002), there are three forms of motivation:

- Intrinsic motivation is the most self-determined form of motivation. It is the tendency to engage in an activity for the pleasure of learning and discovering new things. Thus, a student who attends the course of geometrical optics (GO) for his pleasure and the satisfaction that learning new knowledge in this area gives him is a good example of a person motivated intrinsically;
- Extrinsic motivation is the fact of engaging in activities for purely instrumental and external reasons

ISSN 2229-5518

to the activity itself. For example; the student who is taking science course to satisfy his father;

- The amotivation is the lowest level of self-determination. A person amotivated, is neither intrinsically nor extrinsically motivated. For example; the student who attends the science course without reason.

The theory of self-determination considers that motivation is all the higher when the behaviours used have been chosen freely and for pleasure (intrinsic motivations) (Vallerand & Thill, 1993).

Because learning is possible only if the learner is motivated and wanted to learn, motivation has attracted the attention of many researchers in science education, (Strike & Posner, 1992; Litchfield & Newman, 2001; Novak, 1979; Pintrich, 1999; Viau, 1994; Amoozegar, Daud, Mahmud & Jalil, 2017, Blizak, 2017;……). The results of their studies have shown that motivation for learning seems to be responsible for student success and failure. It is linked to a variety of important academic outcomes, including curiosity, perseverance, learning, and performance. According to Bloom (1976, cited in Novak, 1979) the learning success of high school students can be explained to 25% by motivation. Strike and Posner (1992) recognize the importance of motivation in the learning process on conceptual change and knowledge acquisition. It plays a key role in conceptual change and learning new concepts (Pintrich, 1999). Also, Litchfield & Newman (2001) consider motivation as the main drive which gives the maximum effort needed to achieve the learning objectives. Learners with better disposition and personal motivation have much more capacity for learning (Santander, 2011). As Hwang, Echols, & Vrongistinos (2002) showed, the motivation can be increased by varying the number of learning sources and teaching methods. For them, the more a student's pleasure increases, the more motivated he is to learn. According to Amoozegar, Daud, Mahmud & Jalil (2017) students with more highly motivation are likely to be involved in learning and perform better and more satisfied.

Brophy (1992) emphasized the importance of distinguishing between general motivation and specific motivation. Therefore, the use of effective strategies to improve students' motivation towards a specific subject, such as geometric optics becomes necessary.

Optics education research has focused on students' conceptions and precisely their misconceptions (Blizak, Chafiqi & Kendil, 2009). Other work has been based primarily on teaching strategies, with the goal of conceptual change. We note here that the strategies of conceptual change are related to constructivism: knowledge can't be transmitted, but must be constructed by the learner. But a student who is not motivated can't build his knowledge or be responsible for his learning. There is a positive correlation between intrinsic motivation and students' understanding (Blizak, 2017). Uzun, Alev, & Karal (2013) state that students at all levels of education should be aware of light phenomena without being able to articulate explanations. This is due, according to these scientists, to programs that focus on knowledge rather than understanding.

Some investigations show that teaching and learning physics within the context of everyday life phenomena may be very stimulating and successful. Physics lessons have to be combined with everyday life phenomena and problems:

"*There may be established connections between school physics and everyday life in an affectively positive atmosphere. This is of great importance from an educational point of view because the restriction of physics to subjects and phenomena which only occur within physics and which do not provide any possibility to be encountered in the daily world are committed to oblivion*" (Schlichting, 2006, p.51).

Natural optical phenomena occur in nature, in which the human being has had no intervention. As Berry (2015) stated, natural optical phenomena have been implicated in the development of a surprisingly large number of scientific concepts. Here are some examples about atmospheric optical phenomena:

- Rainbow is one of the most impressive phenomena on atmospheric optics, which is caused by the dispersion of the scattered light from water droplets (Sakurada and Nakamur, 2002).
- Sun Halos or moon halos have the shape of rings, generated by the refraction or reflection of sunlight or moonlight by ice crystals suspended in the atmosphere (Hong, & Baranoski, 2003).

- Mirage is the impression that the object one is looking at is somewhere other than its actual location. It is due to the variation of the refractive index of air layers of different temperatures (Delmas, 2012).
- Shadows are formed because of the absence or prevention of the propagation of light by objects (Grigorovitch, & Nertivich, 2017).
- Crepuscular rays known as sun rays diverge through holes in the clouds. The light rays are visible with air lit by darker, shaded areas and can be observed at any time of day (Van Den Broeke, Beasley & Richman, 2010).
- Lightning accompanies the storm due to an atmospheric disturbance associated with the presence of a cloud called cloud storm involving electric shocks (Maunder, 2007).

Man could not become aware of his existence without becoming aware of the world around him. Nothing is better than the visual image to coexist with this world and appreciate nature. This is why Plato uses optical phenomena to set the image:

"I firstly call images the shadows, then the reflections we see on the water or on the surface of opaque, polished and brilliant bodies, and all similar representations" (PLATO, cited by Brandão et al., 2011, p:171).

According to Martine (2002), the image is the direct way to present an object to a person by presenting the same subject so that he can understand the nature of this subject with all his senses where he can make the same feelings in the same way. As stated by Paul Claudel, the image represents the real enclosed in a small "*durable square, portable, something now and forever at your disposal*" (cited by Frangne, 2010, p.10). It has another meaning for Gervais (2003). He defined it as a mode of knowledge that gives knowledge shapes, which can seduce and provide pleasure.

Indeed, the image invades our daily lives in very different forms. It fills several roles in our life. The image also becomes a very indispensable element of communication. It is endowed with a considerable capacity born from its power of demonstration in relation to speech. It is a pleasant medium and synonymous with entertainment (Bourissoux & Pelpel, 1992). Also, Richaudeau (1979) indicates that the image would have an increased intentional, explanatory and retentive effect. This leads us to consider, according to Duval (2003), that any visualizing representation could be self-sufficient. Thus, the image techniques provided many options for the teacher that can't be ignored but utilized and harnessed to serve the learning process. It currently occupies an important role in society. Bourissoux & Pelpel (1992), emphasizes the importance of the use of the image as an essential element in pedagogy. He considers it as a means of teaching and a tool for learning about the world. For Joffe (2007), the image has a certain affective power that the text does not have. While Florey & Cordonier (2017) claim that the image accompanies, completes or replaces the text, especially in the modes of existence of operational knowledge.

There are several forms of images. But nowadays, students prefer the photographic image. It is easier and faster to use the mobile phone, digital camera, webcam or tablet to have a nice picture. Photography is a technical object considered as a scientific instrument of discovery and as a fascinating and charming image. It is at the same time an instrument of truth, a means of information or authentication (Frangne, 2010).

Although researchers in science education argue that the use of ICT and experiences is very important for students' achievement, GO teaching with traditional methods can't be neglected in our university, especially in the biology department. We have large groups of students in addition to the lack of technological supports. Therefore, in GO courses, conferences (traditional pedagogy) often cover a large part of the program over a limited period of time. In this context, the mission of finding an effective and less costly way to motivate students in our university to learn GO, challenged us. Like many scientists, we believe that the photographic image of an atmospheric phenomenon taken by the student himself could very well increase his motivation to learn OG.

In the light of the ideas outlined above, this study aimed at investigating the effect of atmospheric optical phenomena (AOP) photographed by university students to improve their learning motivation level for geometrical optics. This objective will be examined taking into account the gender of the students.

RESEARCH QUESTIONS

We express our problematic by the following research questions:

1. Will the use of atmospheric optical phenomena (AOP) photographed by university students have significantly different effects on the level of intrinsic motivation to learn geometric optics compared to students who taught just traditional courses?
2. Will the use of atmospheric optical phenomena (AOP) photographed by university students have significantly different effects on the level of extrinsic motivation to learn geometric optics compared to students who taught just traditional courses?
3. Is there a difference between male and female students in their motivation intrinsic to learn GO in pre-test and post-test?

2 METHOD

2.1 Sample

Department of Biology in the faculty of sciences in Boumerdes University, Algeria, was selected for this purpose. 200 students in first year university participated in this research. 70,5% of them were female. The average age of the students was 18.24 years with a standard deviation of 1.86 years. All students in our sample took 3 hours GO courses per week for 3 months during the 2017/2018 academic year.

2.2 Design and Procedure

The study used the semi-experimental method. The sample was divided in two groups, one of which was randomly selected to be an experimental group (EG), and the second was a control group (CG). CG consists of 35 students and EG 165 students. The GE has been divided into two groups. GE1 (N=38) was used to answer research questions 1 and 2, while the GE 2 was used to answer the third research question. More students in the department of Biology in Boumerdes University are females. That's why we decided that only EG2contains male students. (N=59). All students were taught in formal classes under the same conditions. However, we asked the students in the experimental group to take pictures of an atmospheric optical phenomenon (AOP) and to explain it based on the physical laws (refraction, reflection, propagation of light, formation of an image, ...). We then asked the students to represent their work by posters (Figure 1).The control group studied geometrical optics as usual (without taking photos). All students had geometrical optics motivation scale (GOMS) before and after studying GO. GOMS was developed by the authors (Blizak & Chafiqi, 2014). The scale includes 28 items dividing in 3 sub-scales; Intrinsic Motivation (IM), Extrinsic Motivation (EM) and Amotivation (AM). It had acceptable level; internal consistency and temporal stability. The Cronbach alpha coefficient was found to be 0.88, 0.80 and 0.95 for the IM, EM and AM sub-scales, respectively. These values of α are considered acceptable. The GOMS is scored on a 5-point Liker scale ranging from "1"= Strongly Disagree to "5"= Strongly Agree. It is given to the students as pre and post-test. As we limited our study to intrinsic motivation and extrinsic motivation, we made the decision not to use the third sub-scale (Amotivation) of the GOMS. This test was done in the language of instruction (French). To answer the research questions, the data obtained were analyzed using Statistical Package for Social Sciences (SPSS 20) for Windows 7. The design of this study is given by concept map showed in Figure 2.

Figure 1 : posters of photos of AOPs photographed by students

ISSN 2229-5518

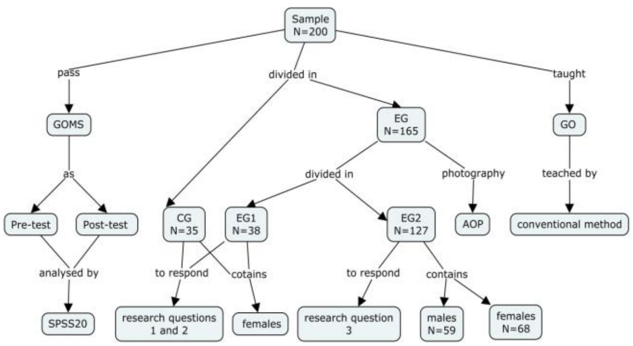

Figure 2: Design the Study

3 FINDINGS

Before students have their GO courses, we compared the averages scores of the students to the pre-test in GOMS for IM sub-scale and EM sub-scale. A t-test for independent samples showed that there were no significant differences between EG1 and CG for IM [t(71)= 0.45, p =0,656] and EM [t(71) =0,064, p = 0,949] (see table 1). In the EG2, there were no significant differences too between girls and boys. [t(125) = 1,284, p=0,202]. It means that all students, participating in this study, have the same level of motivation before studding GO (See table 2).

TABLE 1

MEAN SCORE AND T-TEST FOR INDEPENDENT SAMPLES

GOMS sub-scale	Group	Test	N	Mean	Sd	t	df	Sig.
MI	**CG**	Pre-Test	35	15,143	3,02316	1,780	34	,084
		Post-Test	35	15,0857	2,99383			
	EG1	Pre-Test	38	14,1842	3,27856	12,862	37	,000
		Post-Test	38	21,6316	2,28297			
ME	**CG**	Pre-Test	35	18,9143	2,63875	1,876	34	,069
		Post-Test	35	19,3714	2,41424			
	EG1	Pre-Test	38	18,9474	1,70765	1,953	37	,058
		Post-Test	38	19,5526	1,70369			

As shown in Table 1, the mean score in IM of GOMS for the EG1 increased from the pre-test (M=14,18, Sd=3.28) to the post-test [M= 21.63, Sd=02.28; t(37)=12,86, p=0.000]. Although, for the CG, the post-test mean score (M=15.08, Sd=02.99) was slightly less than pre-test [M=15,14, Sd=03.02; t(34)=1.78, p=0.084], with no significant difference. Concerned the students mean scores in EM of GOMS in pre-test and post-test the difference between them is not significant in both groups.

Also, in post-test, students from the EG had obtained higher mean scores for IM (M=21,63, Sd=2,28) compared to the students from the CG (M=15,08, Sd=2,99). The independent samples t-test result was unable to show a significant difference between the groups [t(71)= 10,55, p=0,000].

Concerning extrinsic motivation, the independent samples t-test shows that there was no significant difference in GOMS post-test mean scores for the EG1 and CG [t(71)=0,373, p=0,71]

ISSN 2229-5518

TABLE 2

T-TEST FOR INDEPENDENT SAMPLES FOR EG2

GOMS sub-scale	Test	Gender	N	Mean	SD	t	df	Sig.
MI	Pre-Test	M	59	13,4068	3,26485	1,284	125	,202
		G	68	14,1618	3,33954			
	Post-Test	M	59	16,2373	3,09248	8,183	125	,000
		G	68	20,7059	3,04228			

Table 2 also shows simple differences in the mean between female and males of GE2 in intrinsic motivation to learn GO. To find out the significance of these differences, the t-test was used. The results showed a statistically significant mean difference in post-test totals score in favour of females [t(125) = 8,183, p=0,000].

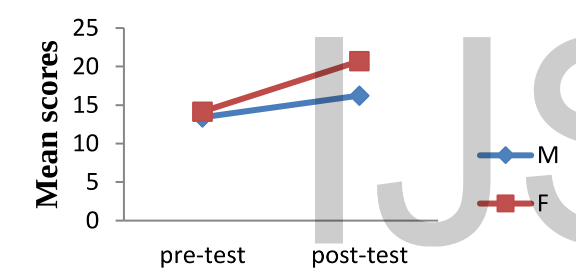

Figure 3: Averages scores at GOMS in CG and EG1

The figure 3 clearly shows the increase of mean score from pre-test (M=16,24, Sd=3,09) to post-test (M=20,70, Sd=3,04) for females and males in EG2. It is very clear that the use of OGP, had a positive effect on IM to learn GO in female students.

4 DISCUSSION OF RESULTS

The purpose of this study is to investigate the effect of atmospheric optical phenomena (AOP) photographed by university students to improve their learning motivation level for geometrical optics. Therefore, we asked three research questions.

The first question related to the effect of atmospheric optical phenomena (AOP) photographed by university students have in the level of intrinsic motivation to learn geometric optics courses. The results showed that the intrinsic motivation to learn GO about the students who had the experience of AOP images improved very well in post-test.

The second question related to the effect of atmospheric optical phenomena (AOP) photographed by university students have in the level of extrinsic motivation to learn geometric optics courses. The results showed that there is no significant difference in extrinsic motivation scores between pre-test and post-test.

The third question related differences in intrinsic motivation to gender. The results of the analysis of the survey indicated that there was a large difference between males and females' scores in their intrinsic motivation to learn GO. The girls were more interested than the boys at the AOP. That's why their motivation was greater. Our result disagrees with the result of Yau, Kan and Cheng. They found that there is no significant gender difference on the level of intrinsic motivation, among the targeted group of university students in Hong Kong. While, the research study of Kissau (2006) shows that the gender differences in school motivation are related to age or grade and subject. What the result of this study argues: the intrinsic motivation for learning can be gender-related in some subjects such as OG. The teaching situation that focuses on the student and uses means that he found in his everyday life or in the nature that surrounds him, not only, it contributes to a constructive learning that facilitates the learning and acquisition of knowledge, it also promotes curiosity and pleasure. When students discover knowledge themselves, it builds self-confidence and intrinsic motivation for learning.

5 CONCLUSION

Despite the unsatisfactory results of traditional teaching methods in the learning of sciences, higher education in our country cannot ignore them for the reason of the increase of the number of first-year university students and lack of resources to use more modern technology like simulation and experiences. Also, there is need to motivate students in the biology department towards studying GO or physics so that the learners can acquire knowledge and concepts that will be relevant in their future studies. We have taken upon ourselves the task of looking for easy and effective ways that can have a positive effect on the learning of physics in general and OG in particular. In this context, this study had as purpose to investigate the effect of atmospheric optical phenomena photographed by university students' on their learning motivation in geometrical optics (GO).

The results obtained showed that the intrinsic motivation to learn GO about the students who had this experience improved very well, especially among the females. However, no effect was noted on the level of the extrinsic motivation.

We know today that every cognitive process has an affective dimension that provides it with the energy necessary for its fulfillment. The nature that surrounds us is a suitable means for effective learning in the student. She awakens her pleasure, arouses her curiosity, attracts and mobilizes her attention. Therefore, we must seek to define methods and resources to exploit it in the classroom, to invest its enjoyment and playfulness in accomplishing different learning tasks. The image is a means of communication; a good image can replace thousands of words. Through a photo of an optical phenomenon, nature speaks and reveals us its secrets.

Based on the results of the study, the researchers recommend the following:

- Give more importance to the atmospheric optical phenomena in the learning process of the geometrical and physical optics at all levels of education, in order to improve motivation for learning.
- Conduct similar studies on the atmospheric optical phenomena for other levels of education such as secondary and primary level.
- Conduct broader studies on the effect of atmospheric optical phenomena on learning achievement.

REFERENCES

[1] Amoozegar, A., Daud, S. M., Mahmud, R., & Jalil, H. A. (2017). Exploring Learner to Institutional Factors and Learner Characteristics as a Success Factor in Distance Learning. International Journal of Innovation and Research in Educational Sciences. 4 (6), 2349–5219.

[2] Blizak, D., Chafiqi, F., & Kendil, D. (2009, June). Students misconceptions about light in Algeria. In Education and Training in Optics and Photonics (p. EMA5). Optical Society of America.

[3] Blizak, D., & Chafiqi, F. (2014). L'effet de L'utilisation de L'histoire des Sciences dans Enseignement de L'optique Geometrique sur La Motivation d'Apprentissage. Scientific Annals of the'Alexandru Ioan Cuza'University of Iasi: Educational Sciences Series/Analele Stiintifice ale Universitatii'Alexandru Ioan Cuza'-Sect. Stiintele Educatiei, 18.

[4] Blizak, D. (2017, June). The Effect of Using the History of Sciences on Conceptual Understanding and Intrinsic Motivation. In Asia-Pacific Forum on Science Learning and Teaching (Vol. 18, No. 1, p. n1). Hong Kong Institute of Education. 10 Lo Ping Road, Tai Po, New Territories, Hong Kong.

[5] Berry, M. V. (2015). Nature's optics and our understanding of light. Contemporary Physics, 56(1), 2-16.

[6] Brandão, E. A., Muniz, R. M., Gonçalves Filho, C., Rocchiccioli, G. F., Souki, G. Q., & Livramento, R. (2011). Brand relationships on retailing: The impact of image on behavioral intentions of consumers. Revista de Administração da UFSM, 4(1), 170-186.

[7] Brophy, J. (1983). Conceptualizing student motivation. Educational psychologist, 18(3), 200-215.

[8] Brophy, J. (1992). Probing the subtleties of subject-matter teaching. Educational Leadership, 49(7), 4-8.

[9] Bourrissoux, J. L., & Pelpel, P. (1992). Enseigner avec l'audiovisuel. Les Editions d'organisation.

[10] Deci, E. L., & Ryan, R. M. (Eds.). (2002). Handbook of self-determination research. University Rochester Press.

[11] Delmas, A. (2012). Contribution pour une place raisonnée de l'émotion dans la compréhension/interprétation et la réception des oeuvres multimodales à l'étude de l'effet mirage: application aux mesures dimensionnelle et thermique par caméras visible proche infrarouge (Doctoral dissertation).

[12] Duval, R. (2003). Décrire, visualiser ou raisonner: quels 'apprentissages premiers' de l'activité mathématique. In Annales de Didactique et de Sciences cognitives (Vol. 8, pp. 13-62).

[13] Florey, S., & Cordonier, N. (2017).. Revue de recherches en littératie médiatique multimodale, 6.

[14] Frangne, P. H. (2010). L'image déhiscente. Gautier et la photographie de montagne des frères Bisson. Etudes photographiques, (25), 3-20.

[15] Gervais, T. (2003). D'après photographie. Premiers usages de la photographie dans le journal L'Illustration (1843-1859). Études photographiques. http://journals.openedition.org/etudesphotographiques/303.

[16] Grigorovitch, A., & Nertivich, D. (2017). Représentations mentales des élevés de 10-12 ans sur la formation des ombres/mental. European Journal of Education Studies. 3 (5), 150-160.

[17] Hong, S. M., & Baranoski, G. (2003). A Study on Atmospheric Halo Visualization. Technical Report CS-2003-26.

[18] Hwang, Y. S., Echols, C., & Vrongistinos, K. (2002). Multidimensional academic motivation of high achieving African American students. College Student Journal, 36(4), 544-555.

[19] Kissau, S. (2006). Gender differences in second language motivation: An investigation of micro-and macro-level influences. Canadian Journal of Applied Linguistics/Revue canadienne de linguistique appliquée, 9(1), 73-96.

[20] Joffe, H. (2007). Le pouvoir de l'image: persuasion, émotion et identification. Diogène, (1), 102-115.

[21] Litchfield, B.C., & Newman, E.J. (2001). Difference in student and teacher perceptions of motivating factors in the classroom. National Forum of Applied Educational Research Journal. http://www.nationalforum.com/.

[22] Martine, J. O. L. Y. (2002). L'image et son interprétation. Paris, Nathan.

[23] Maunder, M. (2007). Lights in the sky: identifying and understanding astronomical and meteorological phenomena. Springer Science & Business Media.

[24] Nasser, N., El Khouzai, M., & Taoufik, M. (2017). Difficultés d'apprentissage des sciences physiques chez les élèves du secondaire qualifiant au Maroc. American Journal of Innovative Research and Applied Sciences, 5(2), 119-125.

[25] Novak, J. D. (1979). Position papers: the reception learning paradigm. Journal of research in science teaching, 16(6), 481-488.

[26] Richaudeau, F. (1979). Le langage efficace.Paris, Marabout.

[27] Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. International journal of educational research, 31(6), 459-470.

[28] Sakurada Y and Nakamura T 2002 Demonstration of the light scattering phenomenon in the atmosphere Proc. SPIE 4588 490–8.

[29] Schlichting H J 2006 Reflections on reflections—from optical everyday life phenomena to physical awareness Informal Learning and Public Understanding ed G Planinsic and A Mohoric (Ljubljana: University Press) pp 40–52

[30] Strike, K. A., & Posner, G. J. (1992). A revisionist theory of conceptual change. Philosophy of science, cognitive psychology, and educational theory and practice, 176.

[31] Uzun, S., Alev, N., & Karal, I. S. (2013). A Cross-Age Study of an Understanding of Light and Sight Concepts in Physics. Science Education International, 24(2), 129-149.

[32] Vallerand, R. J., & Thill, E. E. (1993). Introduction au concept de motivation. Introduction à la psychologie de la motivation, 3-39.

[33] Van Den Broeke, M. S., Beasley, W. H., & Richman, M. B. (2010). The role of atmospheric conditions in determining intensity of crepuscular and anticrepuscular rays. Monthly Weather Review, 138(7), 2883-2894.

[34] Viau, R. (1994). La motivation en contexte scolaire. Éditions du Renouveau pédagogique,

[35] Yau, H. K., Kan, M. S., & Cheng, A. L. F. (2011). Gender differences on Intrinsic Motivation in Hong Kong Higher Education. E Journal of Organizational Learning & Leadership, 9(2).