



ISSN: 1813-162X (Print) ; 2312-7589 (Online)

Tikrit Journal of Engineering Sciences

available online at: <http://www.tj-es.com>

TJES
Tikrit Journal of
Engineering Sciences

Husein HA, Baper SY, Salim SS. The Impact Of Colour On Students' Perception In Learning Spaces *Tikrit Journal of Engineering Sciences* 2021; 28(2): 33- 43.

[Salahaddin Yasin Baper](#)

[Husein Ali Husein](#) *

[Sazgar Samir Salim](#)

Department of Architecture, College of Engineering, Salahaddin University, Erbil, IRAQ.

Keywords:

Colors, Perception, learning spaces, students, classrooms.

ARTICLE INFO

Article history:

Received 18 July 2020
Accepted 04 June 2021
Available online 27 June 2021

THE IMPACT OF COLOUR ON STUDENTS' PERCEPTION IN LEARNING SPACES

ABSTRACT

Color has a crucial impact on students' perception. It encourages the learning atmosphere to be affiliated with the anticipated learning outcomes. The purpose of this study is to investigate the impacts of contextual colors on student's perception of interior spaces and to validate previous related studies that emphasize on colors as a media to convey meanings that affect behaviors and students' perception as well. Accordingly, the objective of this study is to determine and validate previous related studies regarding the impact of background color on student's perception. Meanwhile the study evaluates the previous relevant models in order to validate or reject previous assumptions. The study concentrates on quantitative survey method using in depth questionnaire to determine student's perception at UHD-University of Human Development, Sulaimani. Seven Colors from Munsell color system (yellow, green, blue, purple, white, and black, grey) are applied in the test in order to indicate the students' perceptual status. The results show that cool colors like white, green and blue are mostly recommended for educational spaces. These colors affected positively the perception of respondents and add feeling of hope, curiosity and satisfaction to the group. In contrast dark colors (black and grey) are indicated as colors of worry and fear. The findings demonstrate that environments colors play an important effect on student's perception. The study concluded that colors affect the behavior, performance and mood of the space users.

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DOI: <http://doi.org/10.25130/tjes.28.2.03>

*Corresponding author: [Husein Ali Husein](#), Department of Architecture, College of Engineering, Salahaddin University, Erbil, IRAQ.

تأثير اللون على ادراك الطالب في فضاءات التعليم

صلاح الدين ياسين باپير قسم الهندسة المعمارية/ كلية هندسة / جامعة صلاح الدين- أربيل
حسين علي حسين قسم الهندسة المعمارية/ كلية هندسة / جامعة صلاح الدين- أربيل
سازگار سمیر سلیم قسم الهندسة المعمارية/ كلية هندسة / جامعة صلاح الدين- أربيل

الخلاصة

للون تأثيره الأساس في إدراك الطلبة فهو يحدث على التعلق بجوانب التعلم ومحيطه لتحقيق نتائج التعليم المرسومة والمتوقعة. إن غرض هذه الدراسة هو التحقق من تأثير الألوان المستخدمة في النصوص التعليمية في إدراك الطالب وفهمه في فضاءات التعليم الداخلية وكذلك تهدف الدراسة إلى تعزيز ودعم ما توصلت اليه الدراسات السابقة ذات العلاقة والتي أكدت على تأثير الألوان كوسيلة لنقل المعاني التي تؤثر في سلوك وفهم الطلبة . وعليه فإن هدف الدراسة العام هو تقييم ما انتهت اليه الدراسات السابقة وتأييد أو تفنيد ما افترضته من فرضيات فيما يخص تأثير ألوان المحيط التعليمي في فهم الطلبة وفي ذات الوقت فإن هذه الدراسة ترمي إلى تقييم النماذج السابقة والتي هي على تماس مع موضوع هذا البحث لأجل تعزيز أو دحض ما افترضته تلك النماذج.

وتركز هذه الدراسة على طريقة المسح الكمي باعتمادها الأستبانة أداة لجمع المعلومات الدقيقة عن جامعة للتنمية البشرية في السليمانية . وقد شمل الأختبار على سبعة ألوان من ألوان نظام منسل الا وهي (الأصفر ، والأخضر ، والأزرق ، والبنفسجي ، والأبيض والأسود ، والرصاصي) لبيان حالة إدراك الطالب وفهمه . وأثبتت نتائج الدراسة أن الألوان الباردة مثل الأبيض والأخضر والأزرق هي المرحة للاستخدام في الفضاءات التعليمية لأنها ذات أثر إيجابي في إدراك وفهم المتلقين وانها تضيف الشعور بالأمل وحب الاستطلاع والرضا للمجموعة الطلابية . وعلى النقيض من ذلك ، فإن الألوان القاتمة كالأسود والرمادي قد اتضح أنها ألوان القلق والخوف . وقد برهننت النتائج بأن ألوان البيئة لها أثرها المهم في إدراك واستيعاب الطلبة وخلصت الدراسة إلى أن الألوان تؤثر في سلوك وأداء ومزاج المستخدمين للفضاء التعليمي .

الكلمات الدالة: الألوان ، الإدراك ، فضاءات التعلم ، الطلاب ، القاعات الدراسية.

1. INTRODUCTION

Color has a significant role in everyday life; it can be perceived by visual sensors that affect human beings physically and psychologically with or without our realization. Different colors are associated with different emotions, for instance, Red has an exciting effect, it has active, also it has negative influences

[1]

Color in interior design is a significant factor in creating perceptions about different spaces. It affects the behavior, performance and mood of the space users. Recently one of the main topics in architect's and psychologist's researches is Perception. Perception is a cognitive process that gives the meaning to the informations collected by five sensors and makes the interpretation of the environment around us. Perception differs from one person to another depending on their personality. We may receive information by our sensors equally but we assign different meaning to what we received differently [2]. One of the experienced physical environments that we perceive is the spaces we live in. Experiencing interior colors is different from any other color used as interior is a three-dimensional character that wraps you in color, color surfaces are above, around and beneath you. One of the indoor environments that are occupied by large number of individuals is classrooms; people spend a lot of time

like blood, extreme, and hostility. Blue is associated with comfort and green has relaxing effect. Light colors like white have been found to have positive emotion and dark colors like black with negative emotion

in learning spaces from early childhood to puberty.

Characteristics of these spaces affect students learning outcomes, all physical elements of educational buildings' interior design directly contribute to the whole educating system like shape, texture, color, sound and lighting of the space, these elements can promote users perceptual responses by affecting their emotions [3]. With technological developments the use of colors increased in both exterior and interior spaces. Color in learning spaces can improve the learning process, by increasing students' attention span, improve their cognitive abilities and enhance students' perception to their environment. So these spaces need a high quality design and best color selection as they affect the psychology and physiology of the learners [4]. Choosing color that fits learning environment is difficult as different students perceive it differently and have different emotional reactions. Best use of color can attract students to use the spaces. Color can

work as a communication tool between students and surrounding objects.

While there are lots of researches on colors impact on people's emotion and behavior, still in the literature there is a gap in studying correlation of different colors and different thought to improve individuals' excitement [5]. They have a hidden importance on how people feel psychologically and physically. Different colors are perceived differently and symbolize various moods, that is why, we need to know which color is needed for a particular

2. LITERATURE REVIEW

2.1 Theory of colors

Among many color systems, Munsell Color system is standardized internationally due to its accurate color separation Fig. 1. This system identifies color properties based on humans' visual systems for color perception to three basic properties; hue, value (brightness), and Chroma (purity or saturation) according to the inventor of this system Albert H. Munsell, these three attributes are measure scale to define colors [6]. The basic property is Hue that

enclosed space so that the intended users will get maximum benefits from that space.

This research paper attempts to find the effect of colors on human beings, focusing on students as a research area. The perception of learning spaces is highly related to their color. The purpose of the present study is to conduct a survey to find relationship of students color perception, their color preference and their color choice for interior learning spaces. This study examines different colors and how student perceive each one of them in enclosed learning space.

differentiates one color tone from others like yellow from red, and green from blue. Another color property is Value which is the ratio of darkness or lightness of a specific color, its degree starts from full lightness (white) to full darkness (black). The third property is the relative purity or vividness of the colors called saturation, high saturation hue have less grey tone; more grey means more saturation in the same value [6].

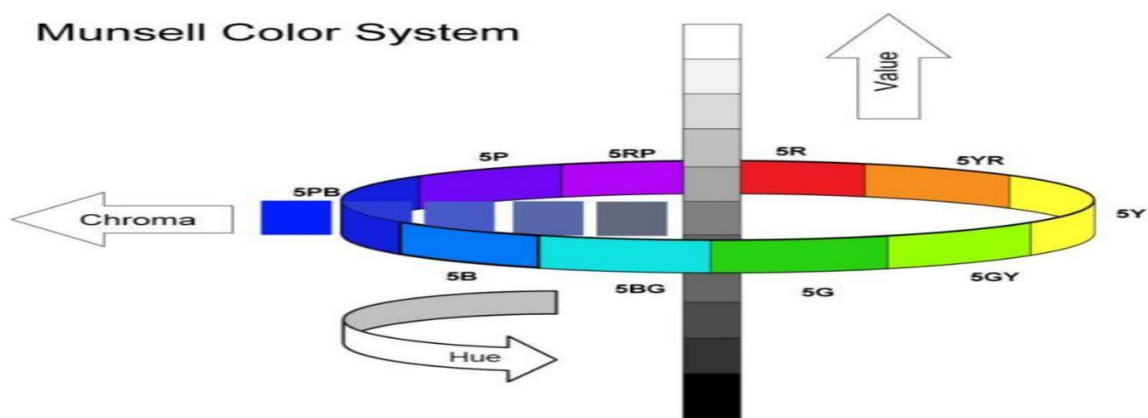


Fig. 1: Munsell color wheel [6].

Human eye has ability to interpret more than 7 million hues that come from three different types of colors, primary, secondary and tertiary. Primary colors are three basic hues; yellow, blue and red, and cannot be got by combining two or more colors. They are basics for achieving other type of colors.

Secondary colors are generated by combining primary hues equally, and equal mixing of primary colors achieves tertiary colors [7]. Interior designers should use the color wheel for using different colors which show which colors can be used together to create perfect combination Fig. 2. This wheel

demonstrates relationships between spectrum colors, contrast colors on color wheel regarded as complementary colors ,using them together makes both colors brighter an create strongest balance. Harmonious colors are next to each other and groups of warm color are opposite to cold colors [8].

Deciding on colors for different interior spaces should fit the desired mood for that space. For example cold colors are important in hospital spaces to calm down patients and warm colors to give more energy in offices. Colors can differentiate between activities and ages like male and female, funny and serious

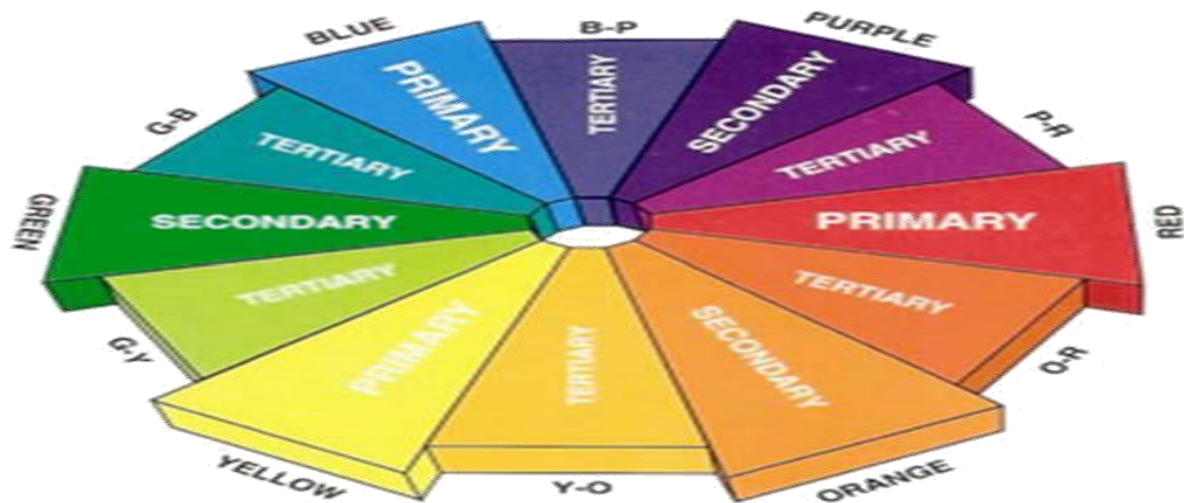


Fig. 2. Color wheel [8].

2.2. Theory of space perception

There are many explanations for defining the meaning of perception, Johnson and Ruitter (2013) [9] defined it as people’s awareness of objects that exist in their environment to realize relationship between them and their surroundings. Perception became the area of interest and focus in many psychologists’ researches, and its purpose is to make a link between individuals and their outside world through sensations [10]. This research is about the color perception which is associated with visual

perception. We are living in a world based on three dimensional objects; space perception creates, contact with this three dimensional environment and spaces outside us. As four senses (sight, hearing, touch and smell) are responsible for perceiving spaces, but space perception is mainly studied as the titles of visual or auditory space perception [11]. This study concentrates on visual space perception which means perceptual experience of surrounding environments by visual sensors.

2.3 Color appearance in visual perception

Color is a visual perceptual property. Johnson and Ruitter (2013) [9] in” color-in-context theory” study individual’s different reaction to color cues. According to this theory colors convey meanings that affect behaviors and perception; it can communicate both positive association that arouse approach-motivational orientation and also negativity that arouses avoidance-motivational orientation. Because

of the direct color processing by brain for the most of time we can’t recognize influences of color on cognitive functioning [7]. They stated that environments color can change the interpretation of the environment, the context add more visual information for colored objects. For example red color has different meanings in different contexts. When someone wears red dress it is perceived to be

more appealing than other colors, but it communicates negativity in the position of academic attainments [12].

According to Kumi, Conway, Limayem, and Goyal (2013) [13] there are four basic psychological colors (red, blue, green and yellow). These colors can influence human emotions, mood and body. Red is Effective and Strong, dominant; it has the longest wavelength; Red catches people's attention as it shows a thing nearer than it actually, red is also exciting and energetic. It can be perceived positively as love and negatively as hate [7]. Green has a calming effect; it symbolizes nature, peace, and gives the feeling of balance and harmony. People perceive green as relaxing as it's a color of nature. Designers sometime use paint in interiors to add more green to

2.4 Student's perception of school colors

Color is an important factor for learning spaces; as it can directly affect the mood and behavior of students, color can enhance learning environments. Its effects are different in different places and different ages [4]. For example investigated color preferences in school for individuals with different ages, their survey showed that children preferred Red color for their classroom while blue is preferred by adult students.

According to research of AL-Ayash, Kane, Smith, and Green-Armytage (2016) [16] about secondary school students perception of colors, students had positive emotions (e.g., happiness, hope, joy) with bright colors like blue, white, yellow, etc. and negative emotions like (sadness, fear, shame) with black, gray and other dark colors. Another study examined college students' emotional associations in Australia Kurt and Osueke (2014) [2] found that bright colors draw out positive emotional associations but dark colors elicited negative feelings. Mikellides (2012) [11] in his study came to the conclusion that black shared both positive and negative responses among young people and mostly

assist human beings to adapt to new environments [14]. Blue is perceived as intellectual and logical thinking motivator that encourages clear thought, increases focus and because of this it is advised to be used in classrooms or studying spaces. It is a calming color because it reminds us of sea water and sky [15]. Duyan and Rengin (2016) [6] said that People perceive Yellow as happiness, friendly, living and open. It is related with comedy and happy temper. It is a symbol of optimism and hope. Yellow encourages creativity and self-esteem [1]. As yellow lets the sun to shine, colors have a different perception in different cultures, for example, Chinese perceives white as grief because they wear it for mourning, in contrast some countries see white as peace and black as gloomy because they wear black for mourning and white for wedding.

they preferred black. Students experienced more anxiety when they are exposed to hot color surfaces compared to those exposed to cold colors [7].

Previous researches demonstrate unclear results about effects of color on students' perception and behaviors; still there is a lot of controversy about effects of colors. For instance, Yildirim, Cagatay, and Ayalp (2015) [17] stated that Red has an awareness effect in classrooms, they examined that student made less error in their tasks, while Jalil, Yunus, and Said (2013) [18] in contrast reached at the conclusions results that Blue color has awakening effects in learning spaces and it increases students' performance. Besides awakening influence, according to some investigations red has an avoidance effect, it is perceived as a warning sign if it is used in learning interior spaces and it makes students fear and feel uncomfortable [2, 3, 14].

Negative impacts are also found in other colors that are believed to have only positivity on students like blue as it has a drowsy effect; it reduces student's awareness [19]. Using gray color as used in some modern schools minimizes students awakening and

concentration. Therefore, color is one of the most important factors in interior design that can change occupants' mood and behavior toward its surrounding. According to this review most of the

3. METHODOLOGY

3.1. Aim of the Study

In order to understand the impact of colors on students' perception in learning environments, it was important to gain knowledge about theory of colors and how different individuals react to different colors in the literature review part. The

3.2. Participants

Participants were 65 college students (29 male and 36 female) at UHD-University of Human Development, Sulaimani city, Iraq, from different colleges (Law, Finance & Banking and College of

3.3. Color Samples

Test color choice for this study depends on the information gained in the literature review. Most researchers demonstrated that red, blue, yellow, Purple, and white could be appropriate colors for learning performances. Most of the investigations are about how these colors affect students learning activity and performances in classrooms but this study attempts to examine how each one of these colors affects the students' perception and finds if

researchers concentrate on few colors like Red, blue, yellow and green. And modern colors need more investigation to found influences in schools.

aim of this methodology part is to test color impacts on students' emotions in educational buildings. So, this study tests the relationship between independent variables which are 7 selected colors and the dependent variable which is students' perception.

language. Participants' ages were between 18 and 26 years and the mean age was 21 years. Almost all participants indicated that they have normal color vision as assessed by the Ishihara color Deficiency test (1993).

these colors are potentially effective for designing contemporary classrooms in the context of contemporary learning methods.

Based on Munsell Color System and previous studies, 7 colors were selected: yellow, green, blue, purple, grey, black and white. The questionnaire's color sample was prepared by using Photoshop software in which Munsell's colors notations were available (in that computer program). The Munsell notations are shown in [Table 1](#).

Table: 1

Munsell color notation

Colour	Hue	Value/ Saturation
Yellow	7.5Y	9/10
Green	2.5G	5/10
Blue	10B	6/0
Purple	5P	5/10
Grey	N/5	
Black	N/1	
White	N/9	

3.4. Procedure

In order to achieve the objective of this Study, a flexible research approach (survey) is used as a method for data collection. The questionnaire is designed according to the factors from studies reviewed in the previous part. Out of 110 questionnaires which were carried out randomly, 65 were returned. The questionnaire includes questions regarding students' color preference, emotional responses for each selected colors and how these colors make them feel? Recommend their colors for

the classroom, 8 positive and negative emotions were used to identify their perception toward each color. The questionnaire also consists of 7 boxes filled with test colors to show the colors to participants. A qualitative approach was used to demonstrate the significant relationship on students' perception and the colors used inside learning spaces. (SPSS) Statistical Package for Social Sciences software program was used to analyze data.

3.5. Findings of students' preference of colors for learning spaces.

As all previous studies, the findings of students color recommendation and perception are varying between male and female participants. Students desired colors for learning areas are shown in Table 2. Mostly students with both genders selected cold colors as white, purple, blue, green in the survey as their recommended color for designing classrooms. White had the highest score among other colors followed with blue and green in overall results. In the case of genders orientation each gender dominate

different color. While it was predicted for female to nominate purple color but more than %28 of them preferred White, and %27 of male selected blue. Among the modern colors used in most of the modern educational building designs, students prefer white and only (%1) to (%4) of both respondent recommended black to be used in learning spaces.

Table: 2

Students desired color in classrooms

Preference color	Male		Female		Total	
	Frequency	%	Frequency	%	Frequency	%
Yellow	2	6.9	7	19.44	9	14
Green	8	27.6	4	11.12	12	18.5
Blue	8	27.6	7	19.44	15	23.1
Purple	2	6.9	6	16.66	8	12.3
Grey	1	3.45	2	5.55	3	4.6
Black	1	3.45	0	0	1	1.6
White	7	24.1	10	28	17	26.1
Total	29	100	36	100	65	100

Table: 3

Students sensations and emotion toward colors

Colors	Male perception	Female perception
Yellow	Hope (%30)	Hope (%24), Excitement (% 12)
Green	Proud (%21), Peace (% 15)	Peace (% 18), Satisfaction (% 15)
Blue	Curiosity (%28)	Curiosity (% 13), Peace (% 12)
Purple	Satisfaction (%23)	Hope (%29).
Grey	Weird (%38)	Weird (%40)
Black	Fear & Worry (%46)	Fear & Worry (65)
White	Active and energetic (%52)	Active & energetic (%37)

3.6. Findings of impacts of Colors on students Perception

In the questionnaire as demonstrated in Table: 3, female participants in associating their sensations and emotion toward colors were more expressive than male respondents. Respondents of both genders mostly rated Yellow as Positive color to perceive and they say Yellow in classroom gives them the feeling of Hope and some other ladies relate it to Excitement. Green color is also related to Good feelings like pride, peace and satisfactions. Blue was described to have the curiosity emotion. Both genders described blue and green as the colors that give them Peace. (%29) of females relate purple to the color of Hope while (%23) of male have satisfactions emotion with this color. As for the modern colors: Grey, Black and White uses by most

of the designers in these days, students regarded Grey as Weird color and black as predicted described as Fear and worry by most of the respondents of both gender. This is quite equal with the findings by Yang et al., (2013) [7]. As mentioned in Literature review that black and gray stimulate negative emotions. Most of the male respondents (%52) rated white to have Active and energetic power, also most Female respondents (%37) stated that white classrooms make them Active and give them more energy. So, according to this Survey light color is more appropriate to be chosen for learning spaces design to improve learning ability.

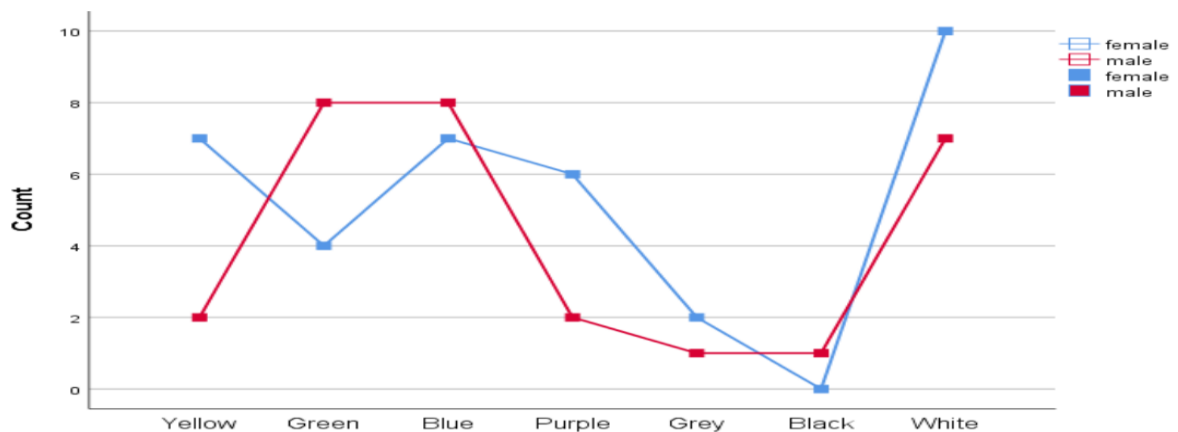


Fig. 3. Classroom color preferences

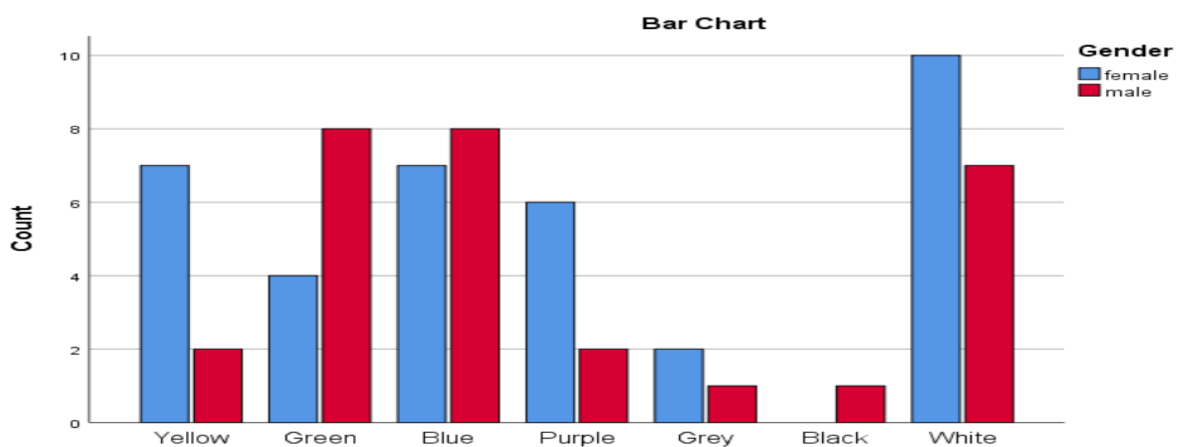


Fig. 4. Classroom color preferences

4. ANALYSIS OF FINDINGS:

According to the participants' answers of the survey there is a significant relationship between male and female in their color recommendation for learning spaces. Table 2 demonstrates the details of the test. There is a significant similar perception between genders for blue grey black and white colors, this finding is quite aligned with the results of perception Mikellides, (2012) [11], they found that cold colors are more preferable by college students than warm colors. And dark colors perceived negatively and that is why they are not recommended by students Fig. 4. Also the findings of this paper show that cold colors (white, blue, and purple) are advised to be used for classrooms compared to warm colors. Negative impacts of warm colors like yellow make it less recommended by these students,

negativity of yellow was less demonstrated by previous researchers compared to red and other warm colors which may be due to shorter wavelength of yellow than other warm colors like red. While in the term of perception most students described yellow as positive color which is contrary to the first findings that they don't recommend yellow that much. Another note is about white color, which is the existing color of their current spaces, were the highest preferred colors among participants and they perceive it as color of energy and activity while according to some studies it should not use for some spaces like performance spaces due to its negative effects [14].

5. CONCLUSION:

The main purpose of this paper is to validate previous related studies regarding the impact of background color on student's perception. The literature review indicates that previous studies demonstrated a significant role of colors on human perception, which means human response to colors. It affects the behavior, performance and mood of the space users. It is interesting to note that Humans perceive color by visual sensors which affect them both physically and psychologically. But during applying previous models on local case various results have been noticed due to social factors that Kurdish students believe in. The Kurdish society set up more emphasis on the singularity of colors which is considered as a reflection of its culture in dealing with multi layered colors. Respondents rated a collection of colors as preferred colors in learning environment. By considering students' perception, ideal learning quality in class designs can be achieved through light colors.

This study discovers the significant impact of colors to create different moods and sensations by students varies and depends on the personality and background of the students. Moreover, this study validates previous models regarding the impact of background color on students' perception.

Generally, Student's preferences for colors in classrooms were cold colors and they perceive cold colors much more positively than warm colors that affect their learning performances negatively. While most of the previous studies indicated negative impacts of White color but the findings of this paper showed that most students perceive white in classrooms positively that they associated it with students' activity and energy enhancer. Blue, yellow and green perceived as the colors of hope, peace, satisfactions by most of the students, but the majority of students recommended abandoning dark colors in classroom designs as it affects students' perception

much negatively. Learning environments should be visually satisfying to motivate learners. While some researchers examined the performance measurement

but more investigations are required to concentrate the color impacts of alertness and attentions in learning spaces.

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