

# The Education Based on Applied Optical-Physics in Opticianry Programs in Turkey

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**Abstract:** Eye diseases that are directly related to human health and eye diseases solutions make the profession of opticianry available and compulsory. Opticians are very important professionals in relation to protect the vision health by helping to choose optical products prescribed by eye doctor. They prepare the proper materials and optical products for vision and ensure the best usage of eye products for patient satisfaction and follow the next process with patient. In this study, the questions of what kind of teaching materials is used in the laboratory of the Opticianry programs in Turkey which is a combined of different age groups in which there are beginners and professionals making this profession for years, whether does the mentioned teaching materials in the mentioned laboratory meet the content of the theoretical and practical courses given during the two year period of the opticianry programs and what is the educational fields that should be completed by opticians are researched. By looking at the results of the surveys, it can be seen that the trainings in the laboratory is insufficient to meet the received courses by opticianry and the universities have responsibilities to overlap the given courses with the laboratories this results shows that opticianry lab training needs to be renewed based on optical physics concepts.

**Keywords:** Turkey, optician, opticianry, consultancy, survey, eye health, optical physics

## 1. Introduction

The technologies, which contain ongoing developments, advances, and innovations especially in opticianry sector, as in many areas of health sector, make the user to renewal information to be expert on. The training of the technical expert equipped with the modern knowledge and skills is becoming compulsory that represents the level of development of a country. The technical experts who can keep abreast of all the latest development in equipment and use are the most important and critical part of the state referred rapid innovations. Eye diseases that are directly related to human health and eye diseases solutions make the profession of opticianry available and compulsory. Opticians are very important professionals in relation to protect the vision health by helping to choose optical products prescribed by eye doctor. In Turkey, to get the title of opticians one has to graduates from the profession at least associate degree. Today, the actions of the expert on opticianry professions are determined by Law and legislation in Turkey. Before the foundation of the Turkish Republic, to the times of the Ottoman Empire, opticianry was not regulated by state as other professional field. This "Law on Opticianry" dated December 30, 1940 and numbered 3953, was composed of 18 Articles, and is considered as the first governmental regulation of opticianry in Turkey [1-2]. 1989, the Institute for Higher Education of Turkey, has decided to start Opticianry Programmes as a pre-bachelor degree course in their faculties. The first of such courses started at the University of Sivas, in 1992 but these graduates had no right to practice as opticians for 12 years. The government had set the new Law numbered 5193 on Opticianry, in 2004. After that, the profession was based on university education and won a new and modern approach in Turkey. The university education to practice profession of Opticianry was being compulsory with the mentioned Law in Turkey. As a result of the both the professions of Opticianry who profess this field recently and enter new into this sector become more acceptable in our time system-level qualifications, so this program generally have participants that have different age

groups. The Opticianry programs are stated about 37 universities in Turkey, in 2015. The interest and participation in this area are increasing with each passing days due to the regulations and requirements imposed by the new Law. This program aims to enable students to gain theoretical knowledge and practical skills required to safely and competently dispense subnormal optical products for vision, contact lenses, and eyeglasses. As mentioned, Opticianry courses are combining of theoretical and application of the profession. Opticianry education aims to train graduates the main knowledge of health which is one of the most important facts of social order besides professional information for optical industry and issues to be equipped with the terminological expressions by providing theoretical courses in which students acquire knowledge in the principles of physics, the basic science of sight and optics, anatomy of eyes, mathematics and administration as well as marketing. The application side of the Opticianry program is the most important part of the education which is given in the equipped laboratory. The application courses in lab provide students to gain required skills of equipment that they will use all of the life of optician. The knowledge of the profession given in the theoretical courses makes students to understand required equipment easily. In the lab of the universities there are some items of equipment which provide just technical skills, such as focometer, pupilameter, eyeglass cutting machine, cavity boring machine which are compulsory for an optical store. In this study we aim to show the necessary of the basic optical physics equipment in these labs and to contribute to the development of the profession of Opticianry Programs in Turkey. In this study will answer the questions of how the status of laboratory of the Opticianry Program in Turkey is, what is the need to overlap the courses with the laboratory materials/machines, how to be different and how to meet if Opticians need to improve itself when graduate from the program. This study can gain a different point of view in the Opticianry Programs in Turkey.

## 2. The Different Age Groups in Opticianry Programs

Living in the same period, the group of individuals with common characteristics can be defined as the generation. In the twenty-first century generation classification is made as Traditionalists, the Baby Boomer, Gen X, Y, and Z. People's perceptions, expectations, attitudes to life, and consequently their behaviors change over time [3-4]. The generation term also examined by the various sciences as a multidisciplinary concept is basically defined as "a series of birthdays of a group of people. The existence of technology has caused rapid changes in the 21st century while the development and rapid changes of technology have been interacting mutually. These changes have formed the basis of new technologies. These changes experienced have brought about the people, who were born in different periods of time, to have different personalities, viewpoints and values. The differences between generations provide some questions in learning where have expressed different opinions. In most of the vocational schools of the universities have profession education with the majority of the student about the same age categories. After the mentioned new Law numbered 5193, the Opticianry programs accept different age group students who want to take diploma for their own optic store. The combining with the students who want to enter profession of Opticianry with opticians who has not license create some diversity in learning. When one thinks about diversity in a classroom of opticianry students, the first thing that comes to mind is racial diversity. An area of diversity that is rarely considered is age as demonstrated in the different generations represented in opticianry students. The opticianry attendances today is composed of millennial students (born after 1982), who represent the typical student attending university immediately after high school; Generation Xers (born between 1961 and 1981), who are the "nontraditional students" returning to university, after beginning or raising a family, perhaps after working in the profession of Opticianry and possibly Baby Boomers (born between 1943 and 1960) pursuing a second career or entering the workforce after raising a family. Generational diversity of program and students presents important teaching and learning considerations because it refers to more than just age differences. The literature on generations tells us that each generation has its own set of values, ideas, ethics, and culture. The millennial (Y) students of Opticianry programs who want to be optician and start to follow the profession of Opticianry learn the terminology dealing by opticianry in difficulty, besides the generation X learn easy because of they are in the profession of Opticianry. In recent works the learning styles of the different generations have represented that the generation X only wants to learn what will benefit them directly, does better when they learn on their terms, and enjoys flexible learning times, however they see class assignments as something necessary to obtain their degree but it is different from work that is necessary to perform the job they desire, besides that the millennial enjoy working in groups, teamwork, use technology whenever possible, experiential activities, and there is zero tolerance for delays, learn immediately from their mistakes [5-6]. No doubt that problems arise from interactions of these generations has the potential to influence all operational

functions of organization from the point of social and business life. Additionally, these generation's differences because of their perceptions on how to learn have caused new learning habits to arise. Actually, in the principal characteristic of the different generations there is the different point of view on facts and events, lifestyles, prized components, expectations, as well as perception management. The important result of created by the different perceptions and values is to be realized in the expectations and knowledge acquired by the resulting gains. It would not be right approach of expecting same output from the individuals who have not same characteristics. Taking into account of all these factors giving in the Opticianry programs which is combining of different age categories to raise students' awareness in optical physics learning can be hard. In this circumstance it is necessary to provide different teaching techniques especially in laboratory which supports theoretical courses.

## 3. The Physics-Based contents of the courses in the Opticianry Programs

The profession of opticianry is related to the behavior of light while passing from one medium into another (air, glasses, cornea, and lens). In our recent work our recommendation was that opticians in Turkey should follow the latest developments through training based on optical physics, attend vocational retraining and refresher courses given at regular intervals and provide information and counseling when needed, just as their colleagues in Europe and the wider world do. In Turkey, in the opticianry course contents there are some courses named with optical physics, geometrical optics or opticianry physics which have the syllabus with the laws of optics [7], in addition, there are also courses with the contents of optical physics such as eyeglass technology, the principles of opticianry, using of optical tools and applications. The topics of optic covered in the two first years of the course. The mentioned courses aim to give students, who may use knowledge all of life, about identification of the light, physical properties of light, definition of the law of reflection, the law of refraction and total internal reflection, the nature of prism to disperse, the light of understanding the reflection on prisms, the idea of image formation by light on human eyes, the behavior of light by optical components, optical equipment such as lenses or glasses, Abbe number, the principles of Shell's Law, application of the Law different mediums, the concepts of electromagnetic spectrum, UV radiation, polarization,... Refraction is one of the main topics of the opticianry education which is the bending of light where its speed is different. As mentioned above, especially Optical Physics generally referred to Geometrical Optical Physics in vocational schools is the study of the interaction between light and matter. The amount of bending depends on the refraction index of the two media and is described quantitatively by Snell's Law in Optical Physics

$$\frac{n_1}{n_2} = \frac{\sin \theta_2}{\sin \theta_1}$$

The topics of Geometrical Optical Physics, eyeglass technology, using of optical tools and also application

include the behavior of light while passing from one medium into another. Generally, the education in opticianry programs is often a passive experience with students sitting in dull lectures memorizing lists of facts to pass endless multiple choice final exams except application courses in which learning is considered an active student-centered activity. The techniques and methods in application courses aim at providing the active participation of students to the learning process have been taken part in the opticianry program. The application courses in lab provide students to gain required skills of equipment that they will use all of the life of optician. The mentioned equipment are focometer which is an instrument for measuring the focal length of a lens or other optical system, eyeglass cutting machine which is useful for cutting eyeglass proper to frames, optical lens grooving machine, optical lens shape tracer, optical lens drill, optical lens centering devices, optical lens polisher, optical lens edger,...All of the tools are useful for processing prescribed optical lens proper to the frames. Using of those tools is just given in the courses of using Optical tools, material information in the syllabus. The mentioned courses aim to provide students practical skills. The Opticianry students use the practical skills when they open the own optical stores or work in the any optical stores. The application in the lab does not provide to the student to understand the main idea of the optical tools or does not overlap the theoretical courses. One of the main theoretical courses is Geometrical Optics which is the branch of physics studying propagation of light using the concept of a ray aims to gain students the concepts of prism, image formation by lenses and mirror, to find the dioptric power of a lenses, the concepts of refraction, the principles of Shell's Law, application of the Law different mediums, the concepts of electromagnetic spectrum, the concepts of reflections, the nature of prism to disperse, the light of understanding the reflection on prisms, the behavior of light by optical components, the effect of the refraction index to the thickness of lenses, refraction index, Abbe number,... The other course is Eyeglass technology aims to give the different eyeglasses such as organic lenses, trivex lenses, polycarbonate lenses, the main idea of the anti-reflective coating, Scratch-Resistant Coating, Anti-Fog Coating, Photochromic lenses, ultraviolet treatment, the amount of the ultraviolet radiation reaching the Earth's surface,...The students can learn in the theoretical courses the idea of the behavior of the light while passing through any media such as lenses and they can find the answer of the questions of why we use different types of the eyeglasses, why our eyes need to use optical eyeglasses, how to correct, what is the refraction index and the effect of high refraction index to the thickness of lenses and to the Abbe Number, what is the value of density and the dioptric power written this information on the lens bag that one's worked any optical store is reading every day. When a patient comes to the store licensed Opticians read prescription given by eye doctor and use the information written on lenses bag, after all, they manufacture lenses to their own specifications and design and manufacture spectacle frames and other devices, as appropriate, for each patient. The opticianry classroom today is composed of students who are the community having different age. Generally the generation X or few Baby Boomer age students know the terminology of opticianry and they are using the concept such as the

refractive index, lenses, the density of lenses, the coated lenses, UV radiation,... and they are using focometer, the cutting machine, the grooving machine almost every day in their own optical stores, however they don't know the main idea of the concepts because there are not any teaching materials based optical physics. When the concepts are supported in the theoretical and application courses they can develop a new point of view, but millennial students generally learn first time all of the concepts dealing with opticianry. The training schedules of Opticianry programs should use various teaching strategies to better meet the learning needs of their students because the mentioned generational diversity such as the experiment of passing light by a medium or lenses, the demonstration of optical functions of the eye, the retina, accommodation (change in the lens curvature) which are hosting the shape of conditions such as myopia and hyperopi and correcting them by optical lenses.

#### 4. Subject and Methods

We have discussed in the earlier work the-at the educations taken in the Opticianry Program have importance of how to use these educations for benefit of society; it is also same for the other profession. When the mentioned issue is healthcare sector the responsibility of profession should be at the top level. In this study the different areas in Turkey were selected about 100 Opticianry students at different Opticianry programs of the universities have been attended to survey. The survey seeks the facts to decide by asking some questions as following, what is your age range, how much time in the Opticianry experience, do you think that you have an advantage during Opticianry training with different age, do you think that the machines/tools in the opticianry laboratory overlap the theoretical and application courses or not, which courses are supported with the laboratory, which courses are supported with the profession of opticianry, which courses will be helpful while working as an optician, what is the most effective learning methods in the university for practicing the profession of opticianry, what is the easy way to learn concepts dealing with opticianry.

#### 5. Conclusion

The result of the survey conducted among 100 students who study in the Opticianry Programs in Turkey reveals the following: As can be seen from this survey, the program attendances of Opticianry most likely represents millennial (30 percent), Generation X (60 percent), the findings show that Opticianry Programs have participants having different age groups, as expected. The majority (50 percent) of students surveyed has 0-3 years of experience in the profession of Opticianry. A part of the students have 3-10 (30 percent) years and the other part of the students has 10 or more (20 percent) years of experience. The findings of this question reveal that most (70 percent) of this information is acquired from students who are in the sector. The answer given to the question about having an advantage during Opticianry training with different age or not indicate that the majority (60 percent) of students are glad of teaching in different age group students. Around half of the respondents of the generations X Opticianry students (50 percent) stated that they are satisfied with this nonhomogeneous distribution of age, however most of the respondents of the millennial



Opticianry students (60 percent) are not, they are explaining this unsatisfying that they cannot understand the concepts of the opticianry easily like generation X during the courses. When asked how the most effective learning methods would be in the university for practicing the profession of opticianry, most (80 percent) preferred technical education in the opticianry laboratory, a part of the students (15) preferred job training in any optical stores which include workplace, the less part of the student (5) preferred theoretical education in the classroom. All (100 percent) of the respondents said that using Optical Tools course, 80 percent of the respondents said that the Material Information and Eyeglasses Technology courses, 20 percent of the respondents said that Geometrical Optics course overlap with the application courses in laboratory. As these findings reveal, it is concluded that opticianry laboratories in Turkey is insufficient to teach qualified optician. Opticianry students just gain technical skills in the existing opticianry laboratories in Turkey. Because of that there is not any material based optical-physics which make up the primary education of the optician; the students cannot understand the main idea of behavior of light while passing through any medium such as eyeglasses lenses, how to be image formation, how to effect the form and the thickness of the lens to image formation, the dispersion of a visible light, also known as white light consisting of a collection of component colors, through prism and the effect of the dispersion on vision quality,... therefore students think that the theoretical courses is not necessary during the education life of Opticianry. In this regard, our recommendation is that the laboratory of the Opticianry programs in Turkey should renew the teaching materials to go along with the practical courses as well as the theoretical courses given in the two year period and the universities in Turkey have responsibilities about it and they also should follow the latest developments through training based on optical physics and integrate this renewal and necessity to the materials in the Opticianry laboratory. To raise students' awareness in optical physics learning The universities have responsibilities to overlap the given courses with the laboratories this results shows that opticianry lab training needs to be renewed based on optical physics concepts.

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