MATHEMATICAL KNOWLEDGE IN THE ACQUISITION OF SKILLS OF BARBING, BRAIDING, AND MAKEUP

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1. Introduction

Mathematics is a fundamental concept in education and life in general. It's determined to a large extent the quality and standard of modern life. It can be said to be a scientific area of study, concerned with shape, relationship, quantity, and uncertainties and is widely noted for its precise, systematic, and organized framework (Ojose, 2011).

The role of mathematics in our daily lives is widely varied and broad (Okafor &Anaduaka, 2013). The importance of mathematics has remained prevalent throughout history and over time, as the nature of the field is not static, but ever-changing and adapting to the changes in the world.

Mathematical knowledge has been noted time and again for its worldwide applicability and usage in all fields, areas, and knowledge domains. This is the major attribute of the subject that makes it so important; as mathematics is often involved even when carrying out minuscule operations in everyday life. An individual unconsciously does several computations and calculations at the back of their mind, every day, and is bound to experience certain difficulties without basic mathematical knowledge. (Mkomango, Liombo, & Ajagbe, 2012).

Mathematics is an integral part of world progress and entails the foundation and basis for universal knowledge and understanding. Apart from its unending role in daily lives, mathematics has also been noted as a necessary tool in discovering the laws of nature, events, and phenomenon around us (Khan, 2015). Kravitz (2013), noted that knowledge of mathematics is required if an individual desire to live effectively in modern society, as it has over time, become necessary if one is to do the essentials of living.

Thus considering its universal applicability, it is worthwhile to assume that its knowledge plays a role in the acquisition of all manner of entrepreneurial skills including cosmetology.

Cosmetology is a field of work concerned with the maintenance of skin, hair, and nails. Cosmetologists are concerned with the aesthesis of an individual; dealing largely with appearance and beauty. It is one of the common fields of entrepreneurship in today's world. It encompasses the field of barbing, makeup, hairdressing, etc. (Houston Training Schools [HTS], 2020).

Cosmetology like every other profession or field of work is characterized by various skills and techniques, needed to be mastered if one is to be successful in the field. Those skills range from those general to the whole cosmetology fields and those specific to each of the cosmetology domains.

Given the above, this study was designed to explore three popular domains of cosmetology; barbing, braiding, and makeup, and the role mathematics plays in acquiring the necessary cosmetology skills.

2. Importance of Mathematics

The concept of mathematics has been associated with a wide variety of definitions over time. Ziegler and Loos (2017), defined it as a science that deals mainly with abstract structures while exploring fields like quantity, structure, space, and change. It is a universal field encompassing all fields of study and knowledge domains, dealing with order, number, their operations, relationships, and is characterized by computations, calculations, and problem-solving (Jayanthi, 2019; Umameh, 2011).

Mathematics influences us and is prevalent all around us daily, in different forms, with it playing subtle roles in all aspects of living (Mkomango et al, 2012). This includes even simple activities like waking up to an alarm, telling the time, money management, and record-keeping, etc. Individuals are confronted daily with a wide range of scenarios that are put to test and require their mathematical knowledge and competence. Roohi (2011), states that the influence of mathematics is also felt in nature, as symmetry and patterns are found all around us and are associated with various natural phenomena like a change of day to night, rising of the sun, and so on. Its successful study and understating can also be personally satisfying and empowering.

Pua and Macutay (2020), states that mathematics and the knowledge and skills derived from it are essential if one is to live properly and effectively in today's modern society. Though its influence is by nature silent and hidden, mathematics helps shape our world in various ways (Amirali, 2010). Ambrosio (2008), states that there is a formidable link between mathematics and the major elements and issues of modern society.

Mathematics encompasses a wide range of domains and fields including the natural sciences, medicine, finance, engineering, and social science. The scientific world [TSW] (2018), states that all other knowledge domains, no matter their nature is dependent one way or another on mathematics. Its knowledge is also fundamental to all manners of vocational areas like carpentering, bricklaying, tailoring, baking, etc. All vocational fields are characterized by daily quantitative processes (Roohi, 2011). In today's scientific world, individuals with a thorough mathematical knowledge are in an infinitely better place for gainful employment and useful opportunities, as science is the vehicle of the future.

Mathematics is also the framework for and an indispensable tool for scientific and economic advancement, as it is the basis for all science subjects. Mathematics is the language of science technology, engineering, and research and is integral to their creation and continued development. The mathematical proficiency of any nation largely determines its level of

scientific and technological development. (Wanjiru, 2015). Ojose (2011), states that mathematics has become so intertwined with the modern world and our current contemporary life; which is characterized by complex systems and structures, that it is required if we are to communicate and comprehend the information all around us.

Mathematics also plays an indispensable role in the building up of the mental faculty. VaraidzaiMakondo and Makondo (2020) are averse that mathematics is an integral part of human thought and logic and key to their continued development. Its study imbues in an individual various psychological and intellectual benefits including problem-solving skills and insights. The mental benefits of mathematics do not just end with the building up of problem-solving skills, but also include the development of reasoning, creativity, critical, analytical and fast thinking, and even communication skills (Jayanthi, 2019). The development of the mental faculty by mathematics is due to the active mental work required in solving mathematical problems.

The mathematical sequences aid an individual's constructive and creative processes. Mathematics is also important in infrastructure development due to its influence over all forms of engineering (Frye, Baroody, Burchinal, Carver, Jordan, McDowell, 2013).

Thus, it is beyond obvious that mathematics plays a vital role in our everyday living, and we will be lost without its knowledge. The necessity of mathematics has and will only continue to increase.

3. Cosmetology and Mathematics

The entrepreneurial skills of barbing, braiding, and makeup all fall under the broad heading of cosmetology. Cosmetology is a profession that typically refers to all fields that deal with beautifying a persons' hair, face, skin, or nails. Houston Training Schools [HTS] (2017), described cosmetology as a career path or field concerned with all forms of beauty treatments, no matter the type of process. Some other fields in cosmetology apart from the traditional barbing, braiding, and makeup include massage, electrolysis, aromatherapy, electro-therapy facials, etc.

At first glance, the presence and utilization of mathematics in cosmetology might not be too obvious, but the fact is that every good cosmetologist needs to possess above-average skills in mathematics, as this is usually transferred to and needed when carrying out various forms of cosmetology procedures (Merchant Circle, 2021). This view is upheld by Dwilson (2021), who state that being a skilled cosmetologist requires a bit of mathematics, and a formal degree in cosmetology from institutions nowadays requires a certain amount of mathematics classes.

The most obvious application for mathematics in cosmetology is in business and money management, as mathematics is needed in all businesses and careers no matter the type. For cosmetologists it is needed in making decisions like the number of clients to see a day to meet financial goals, best products to purchase; taking note of quality versus the prices, etc. Cosmetologist uses mathematical concepts such as ratios, percentages, and angles regularly in all services they perform (Wilcox, 2020).

But the role mathematical knowledge plays in cosmetology goes way beyond business and money management. It can actively influence their skills and competencies. Chapin-McGill (2018), states that if one is to be successful in the beauty industry, such person needs to acquire sharp mathematics skills. Mathematics is needed in carrying out every activity from measuring chemicals, to sterilizing solutions, to managing the whole business.

3.1. General cosmetology skills

All cosmetologists, no matter the type of expertise, require some specific skill set if one is to be successful at the job. These skills go beyond those associated with their domains and are of numerous categories (Indeed Editorial Team [IET], 2020).

Some of those skills needed by all cosmetologists that are related to mathematics include; flexibility, creativity, customer service, ability to visualize ideas, product knowledge, time management, organization, computer, and technical skills

Flexibility is a skill in cosmetology, which refers to the ability to stay informed and aware of current trends in cosmetology especially those connected to ever-changing techniques and modern technologies and equipment (Andrew 2018). New technologies and techniques that enhance processes are continually been introduced to the world of cosmetology and any good cosmetologist is expected to be on par with the latest development. Flexibility also involves adequate competencies with computer and technical skills, utilizing them in the work environment, and being able to adapt to innovations.

Creativity is another vital skill every cosmetologist is expected to possess. This is particularly useful in almost all situations and usually involves a cosmetologists' ability to come up with their style, techniques or designs, when performing various cosmetology procedures such as styling hair or applying makeup. It also involves being able to make their spin on existing designs, adapting them to their use while adding their touch and flair. Dorsey College (2021), cited creativity as the major key to success in cosmetology, stating that any cosmetologist requires some artistic flairs, making it a major career for creative-minded people. The best cosmetologist builds reputations through coming up with interesting variations to trends or in creating their trends. A subset of creativity is the ability to visualize ideas. This involves being able to create a visual and diagrammatic representation of ideas in an individual's mind, even before creation. This is especially useful to decide the best procedure on style to use or create on the individual that will suit their appearance and reap better results.

Due to the nature of the job, a cosmetologist is in contact with people daily, and as such faces continuous scenarios where they are expected to communicate with individuals and maintain effective social interactions for the smooth running of the business. Thus any capable cosmetologist requires customer service skills, which are expressed as communication skills (IET, 2020). A cosmetologist must strive to create a welcoming and friendly environment for their customers, and approach situations in a friendly and reasonable manner. They must learn how to speak and interact with their clients, understand and work with them to provide the service required. A good cosmetologist is expected to ensure that the customer is satisfied with their service, and as Dorsey College (2021), noted, this can only be achieved through active

communication and listening. As a subset of communication, cosmetologist also needs to build networking skills, which is needed in connecting with other professions and clientele.

Another skill required for cosmetology is product knowledge. A good cosmetologist is expected to have comprehensive and detailed knowledge about the various tools and products utilized in their domains or fields, and processes. This skill is especially needed when recommending or describing products to clients, or in deciding the best product to use on a client. Product knowledge goes way beyond just knowing the physical descriptions but also involves an in-depth understanding of other variables like the chemical composition, durability, longevity, etc. (Murphy, 2019).

Another important cosmetology skill is time management. A cosmetologist needs to be versatile in their work environment and situations. They should be able to schedule and use time properly. There are also several cosmetology tools and products that require planning with time if they are to be used properly. This involves situations like calculating how much time it will take for the dye to absorb to hair, time to get tools property sterilized, etc. cosmetologist needs to manage time properly to ensure schedules are being kept appropriately, and customers are properly serviced (Akesha, 2018).

Being organized and orderly is another vital skill required by a cosmetologist. Cosmetologists are typically expected to possess adequate organizational skills, both in their appearance and in maintaining their workplace. This involves organizing their workplace to make it safe and sanitary, and proper storage of tools, products, and equipment. Along with proper storage, being organized may also involve keeping and maintaining product inventory. (Wilcox, 2020).

3.1.1. Mathematical knowledge in general cosmetology skills

As implied earlier, mathematical knowledge is not only present but needed in acquiring cosmetology skills. Some of the applicability of mathematical knowledge to the general cosmetology skills is discussed below;

Creativity is one of the major skills needed by a cosmetologist no matter the type. And as the scientific world [TSW] (2018), states, mathematical knowledge is a major factor in the development of creative thinking and problem-solving abilities. This view is upheld by Roohi (2011), who states that the nature of mathematical knowledge aids in the development of constructive and creative thinking ability in an individual. Mathematics equips an individual with better problem-solving abilities through the development of creative thinking.

Mathematical knowledge is also needed in building effective customer service and communication. Wanjiru (2015), noted that knowledge of mathematics is an integral part of crafting and understanding information and hence communication. Mathematical knowledge is needed by every individual if they are to be equipped with the 21st-century skillset, among which is effective communication and relation. Jayanthi (2019), also averse that a mathematically knowledgeable individual is equipped with better communication skills.

Another major skill needed by all cosmetologists is organization ability. This is another area where mathematical knowledge comes into play. As TSW (2018), states, mathematics is the

pillar of organized life in the present day. For the aspect of the organization that involves keeping product inventory, the cosmetologist requires mathematical skills such as addition and subtraction, and the ability to forecast the amount of time a salon goes through a particular product (Merchant Circle, 2021). Mathematics also helps in finding, understanding, and developing all patterns, a skill that is needed for individual all-around development (Zorfass&Grayi, 2021). And as severally noted, mathematics is a major constituent of creative, constructive, and critical thinking, all of which are skills that boost an individuals' organization. The development of mental faculty by mathematics also boosts an individuals' flexibility (another skill needed by cosmetologists), making them more susceptible and adaptable to changes and ways of dealing with them. Stat-Analytica (2020) supports this view, stating that knowledge of mathematics equips an individual with broader perspectives of solving problems, dealing with situations, and adapting to changes. Mathematical knowledge is also needed for computer and technical advancements, and this is important because cosmetologist is expected to be current with the latest trends and technologies in their fields.

Mathematical knowledge is also universal and applied to all fields (Hadanova&Nocer, 2016), this plays a role in cosmetology skill that requires an individual to be knowledgeable about their products. Mathematics might become necessary in decoding and understanding (among others), variables like the chemical constituents of a product utilized in their fields. AU (2006), supports this stating that mathematical knowledge is usually carried over and utilized in all knowledge domains.

Time management is also another major cosmetology skill, which requires mathematical knowledge. Mathematical knowledge is needed for effective time reading, tracking, management, and budgeting of time. Williams (2020), states that mathematics knowledge imbues in an individual, effective ways to manage and save time. Starr (2017), noted that without mathematics, the cosmetologist will find it difficult to manage time, which is especially needed in this field, as the beauticians have to be precise to cultivate a steady business. Simple mathematics functions like division are used to partition the cosmetologist day into fractional equivalents and stick to them thus enhancing performance over time (Chaplin-McGill, 2018).

Considering all this, it is obvious that mathematical knowledge is needed if an individual is to acquire the general skills needed by all cosmetologists.

3.1.2. Mathematical knowledge in barbing

Barbing is a popular brand of cosmetology, basically concerned with cutting and trimming hair. Barbing is largely associated with the male gender, but the nature of its service is mostly unisex. Over time, the barber's job has grown beyond just cutting off the hair into desired styles, and has come to include other services like hair dying, curling, etc. These extra services are nowadays offered along with normal barbing at salons for clients Mitchel (2020).

Hair barbers need to be skillful with measurements and estimation if they are to carry out more complex styles. A hair barber should be able to estimate and approximate the amount of hair they will be cutting and the angle through which the hair will be manipulated if they are to execute hairstyles properly (Merchant Circle, 2021). Clippers used in styling men's hair are

also indented with numbers and have various length attachments that are measured in fractions of an inch, which the barber needs to be familiar with, as different clipper choices allow for light or deeper cutting.

When cutting the hair, the barber needs mathematics knowledge like geometry and trigonometry to determine how a cut will work concerning the hair length, the hair growth pattern, density, elasticity, and even the shape of the scalp. They need to be familiar with angles, shapes, and various other mathematics principles to determine what hair cut will work best on each client. When cutting hair, barbers employ the principles of geometry and proportion to cut and frame a hairstyle to the clients' faces and features (Davis, 2021). Many popular haircuts are based on geometric angles. Starr (2017), cited geometry as the most needed area of mathematics for barbers. There is also the presence of symmetry patterns when barbing hair, as the stylist usually has to cut around an imaginary axis that helps to establish a balanced finished product.

Knowledge of angles is especially important when cutting the hair into layers with scissors for dealing with curly or textured hair. Chaplin-McGill (2018) states that each time a barber cuts hair, he analyses the head and takes measurements unconsciously. This is especially prevalent for complex cuts and styles where the cut must hit certain angles in a precise, orderly fashion.

Over time, there has been a steady rise in hair coloring, which is sometimes done by the barber. For this purpose, the barber is usually responsible for mixing the dyes and colors themselves and applying them to the individual. To get the right color sometimes involves mixing a variety of liquids or powders and water. The barber has to decide which ratio to mix to get the desired result. This procedure involves knowledge of measurement and fractions, especially to calculate the quantities to be mixed, and the quantity needed to the hair (Dwilson, 2021). Starr (2017), states that creating colors for hair requires accuracy and forethought, and these properties are enhanced with a proper understanding of mathematical concepts like measurement and fractions

3.1.3. Mathematical knowledge in braiding

Braiding is another major area of cosmetology. It's a type of hairdressing that involves partitioning and weaving the hair into a variety of patterns, sometimes employing the use of hair extensions (Dr. Y, 2016).

Merchant Circle (2021), states that hair braiders and stylist needs to be proficient with measurement and estimating. They also need to be proficient with angles, as braiding usually involves positioning the hands at an angle to the hair. In the case where external attachments are being used, the hair braider also needs to be able to measure correctly the length of the attachment needed to achieve the desired style or pattern.

Hair braiders utilize the knowledge of geometry to divide and partition the head into shapes and figure out the correct positioning for those shapes (Davis, 2021). Akesha (2018), states that the neat final product of braids is only possible due to the stylist utilization of knowledge of mathematical concepts like angles.

One of the major parts of braiding, no matter the type is patterns. There exist various patterns in braiding, and this range of patterns constitutes the various styles. As Zorfass&Grayi, (2021) noted, mathematics includes the study of patterns that can be found everywhere, even in nature.

UKEssays (2018), cited a study by Glimer, which was set to uncover the mathematics unconsciously utilized by braiders of black hairs. The study observed and interviewed hair stylists at work in their salons along with their customers. The study noted that the major type/concept of mathematics unconsciously utilized by hair braiders and weavers was 'tessellations'.

Tessellation is a mathematical concept that involves filling up a two-dimensional space by congruent copies of a figure that do not overlap. Tessellations are formed by the combination of translation and rotation of fundamental shapes. The study noted that the concept of tessellations was most evident in the creation of box and triangular braids in the salons they visited.

Inbox braids, the scalp was the center of the tessellations, as it was divided into various similar-sized rectangles, forming a pattern that resembled brick walls. When making triangular braids, the hair was partitioned into small segments shaped like equilateral triangles. The hair inside those triangles was then drawn to the point of intersection of the bisectors for the angles of the triangles. Thus the presence of mathematics when making box and triangular braids is evident (UKEssays, 2018).

Sometimes braiding involves adding layers to the hair through extensions or weaves, and this entails a part of mathematical knowledge (Mitchel, 2020). The concept of addition is utilized to determine how many of those layers need to be added to achieve the desired look and the length of those extensions.

3.1.4. Mathematical knowledge in make up

HTS (2017) described makeup artists as individuals which job entails enhancing the face usually employing the use of colors. This is another cosmetology domain that requires the knowledge of mathematics in its skill acquisition. Dwilson (2021) noted that knowledge of geometry is needed by make-up artists to determine how color and light interact with skin tones.

Sometimes, makeup artists are responsible for mixing cosmetics and colors to be used on their clients and are responsible for determining what ratio of the mixtures would produce the desired result. This process usually requires an understanding of measurements and fractions, if one is to get the proper color or design required. Makeup artist usually pairs colors to highlight or diminish tones to achieve the look the client desires, all these require a certain amount of calculations and computations in the cosmetologist's mind (Murphy, 2019). Percentages are also used in mixing colors and materials for facials (Chapin-McGill, 2018).

5. Conclusion

Mathematics is a universal field of study encompassing all fields and aspects of living. Cosmetology is one of the most popular areas of entrepreneurship, in today's modern society. Since the knowledge of mathematics has been cited to be relevant in all fields, it is natural to

conclude that its knowledge is also prevalent in three of the most popular cosmetology domains; barbing, braiding, and makeup. Thus this study explored the field of cosmetology and examined the role mathematical knowledge plays in its skill acquisition. Mathematics was shown to be prevalent in the acquisition of skills for the whole of cosmetology and even in the distinct domains. Thus, it is obvious that if one is to be efficient cosmetology, such a person requires at least a basic understanding of mathematics.

6. Recommendations

Based on this literature, the following recommendations are made;

1. Mathematical knowledge and its relevance in all fields should be explored.
2. The development of mathematical knowledge and skills should be encouraged, as it is an integral part of living.
3. Individuals who desire a career in cosmetology need to be equipped with basic mathematics knowledge and mathematics.
4. Programs designed for the acquisition of cosmetology skills should be designed in a way that enables the participants to view the necessary skills from a mathematics perspective.

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