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Regular Article

Uncovering relevant mathematics topics for home economics: Senior high school students' views in Cape Coast, Ghana

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ABSTRACT

Mathematics holds universal significance, playing a pivotal role across diverse disciplines in our daily lives. Its impact is crucial for societal development, with mathematics acting as a cornerstone. This study delves into the senior high school (SHS) mathematics topics that students studying home economics consider most relevant to their programme of study and future career needs. Employing an explanatory sequential mixed-methods design, data was collected through a questionnaire and a semi-structured interview guide from grades 11 and 12. Out of a population of 330 students, 286 were sampled using a multi-stage technique, and 277 students filled out the questionnaires, resulting in a 97% response rate. Quantitative data was analysed using percentages and frequency counts, while thematic analysis was employed for the qualitative interview data. Results reveal that ratio and rate, percentages, mensuration, and statistics emerge as the most impactful mathematics topics influencing home economics students' SHS programmes. The study recommends a focus on these topics, urging mathematics educators to always highlight the relevance of any topic they teach to the students' specific programmes of study. These findings underscore the importance of aligning the curriculum with real-world applications, thereby enhancing students' analytical skills and preparing them for future careers.

1. Introduction

Mathematics is a required core subject and consequently unacceptable at any grade lower than C_6 (credit pass) if attempting to obtain a degree at any institution or college in Ghana (MoE, 2010).

Mathematics is a body of knowledge that attempts to interpret and give meaning to situations and experiences (National Council for Curriculum and Assessment, 2019). It has reached every part of the world and has been studied throughout educational history (Furinghetti, 2004). Taber, Sumida, and McClure (2017) established that mathematics is an indispensable tool in the formulation of theories and principles, dominating almost every field of human activity. Noddings (2015) argued that mathematics is an essential subject in the school curriculum, closely related to daily life compared to other subjects. Similarly, Watson (2021) emphasised the need to teach mathematics in schools due to its connection to other subjects and daily life.

In Ghana, development in almost all areas of life is based on useful knowledge of science and mathematics. The government maintains that any country concerned about its development will emphasise the study of mathematics (NaCCA, 2019). Therefore, all pre-tertiary levels of education in Ghana require students to study mathematics as a compulsory subject, serving as a prerequisite for progressing to tertiary education.

Mathematics is particularly useful for those in the culinary profession. Baker (2018) noted that mathematics is necessary for cooks because almost every recipe requires the correct measurement of ingredients. To make anything delicious, the cook needs to know the perfect measurements, a concept rooted in mathematics. Furthermore, if the cook needs to prepare food for many people, they must know how many ingredients are required. According to Baker, every student, especially those specialising in home economics, needs to learn mathematics.

The urgency of raising this issue now is underscored by the latest developments in competency standards for high school students in mathematics, as outlined by the National Council of Teachers of Mathematics (NCTM) and the Programme for International Student Assessment (PISA) by the OECD. The NCTM standards emphasise five key areas: Number and Operations, Algebra, Geometry, Data Analysis and Probability, and Measurement. These standards aim to ensure that

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students develop a deep understanding of mathematical concepts, the ability to reason and communicate mathematically, and the skills to apply mathematics in real-world contexts. The PISA 2022 mathematics framework emphasises mathematical literacy, which includes the ability to reason mathematically, formulate, employ, and interpret mathematics to solve problems in various real-world contexts. This framework highlights the importance of mathematical reasoning and problem-solving skills, which are crucial for students' future careers in a rapidly changing world driven by new technologies.

In the global era, mathematics plays a significant role in students' future careers. It is not just about performing basic arithmetic but also about understanding and applying mathematical concepts to solve complex problems. The ability to reason logically and present arguments convincingly is becoming increasingly important. Mathematics helps students develop these skills, enabling them to make well-founded judgments and decisions needed by constructive, engaged, and reflective 21st-century citizens (NCTM). This study aims to uncover relevant mathematics topics for home economics students in Cape Coast Metropolis, Ghana, in line with the standards set by the NCTM and PISA. By aligning the curriculum with these standards, we can ensure that students are well-prepared for their future careers and can contribute effectively to national development.

1.1. Home economics programme

The missionaries introduced home economics to schools in Africa to equip students with essential life skills (Fleischmann, 2010). The wives of the missionaries initiated the subject, focusing on resolving African women's issues through their unique practices and cultures. This gave rise to the concept of imparting home economics skills to the wives of prominent men in society. The training focused on motherhood, marriage, and homemaking, while the skills included needlecraft, housekeeping, motherhood, and housewifery (Fleischmann, 2010). The subject's focus was on girls, hence preparing them for future roles such as wives, mothers, and domestic workers (Nanayakkara et al., 2018). As a result, people conceptualised the subject as someone who cooks and eats; and sews and wears.

Similarly, Ghana designs home economics programmes to equip students with skills for daily living and employment. Home economics was first introduced in senior high school to provide life skills for the students (Smith et al., 2001). The subject mainly prepared individuals, specifically girls, for future responsibilities, such as wives, mothers, and domestic workers (McCloat & Caraher, 2020). Thus, the content of home economics focuses on preparing students for professions such as technical skills that promote entrepreneurship and independence and make significant contributions to the individual's socio-economic upbringing and the environment. According to Curriculum Research and Development Division [CRDD] (2010), home economics consists of three subjects: food and nutrition, clothing and textiles, and management in-life. The subjects of home economics emphasise the study of the physical, emotional, intellectual, and social needs of the individual, the family, and society. As a result, the welfare of the individual, family, and society is the primary concern in home economics. Home economics manifests this concern by assisting the student in acquiring the necessary skills to enhance the quality and meaning of life in a changing society (p. 2).

2. Literature review

Despite the emphasis placed on the relevance of mathematics by educators, poor results in public examinations (such as the Basic Education Certificate Examination and the West African Senior School Certificate Examination) continue to be reported in most developing countries (Ghana is no exception). Many studies have been conducted to identify the reasons behind students' poor performance in mathematics (e.g., Awoniyi, 2018; Harris & Bourne, 2017; Sa'ad et al., 2014). Nonetheless, poor performance in mathematics persists throughout senior high school (Agommuoh, 2020), and it has become a source of concern for teachers, students, and parents.

Poor performance in mathematics is one of the primary reasons for the decline in the development of any country and the number of students offering science and technology courses (Asomah, Wilmot & Ntow, 2018). Numerous studies (e.g., Conn et al., 2018; Fitzmaurice et al., 2021; Olukemi & Gbenga, 2015) have investigated the relevance of mathematics or specific mathematics topics at the senior high school level to students' programmes of study at the same or tertiary level. In Ireland, Fitzmaurice et al. (2021), undertook a study by interviewing secondary school mathematics teachers to delve into the perceived relevance of mathematics among secondary school students. Their findings suggest that students' limited understanding of mathematics and its application across various programmes could negatively impact their interest in the subject. Consequently, the study implies that when students fail to see the practical relevance of mathematics, they may become disinterested and disengaged from it altogether.

Agah (2020) conducted a comprehensive study in Nigeria, revealing that disengagement and lack of interest are the primary factors contributing to students' underperformance in mathematics. Furthermore, the research elucidated the crucial relevance of specific senior high school mathematics topics to students pursuing science programmes, as well as the students' attachment to and appreciation of these topics based on the realisation of their importance. Moreover, it underscored the overarching significance and practical application of mathematics in both personal and environmental contexts. The author emphasised the interconnectedness of science, technology, and society, emphasising that each relies fundamentally on the preceding element. In other words, the individual and society at large appreciate what they value and perceive to be useful to their lives and aspirations.

In the study involving eleventh grader in the Cape Coast Metropolis of Ghana, titled "Are caning and learning friends or foes in Ghanaian secondary schools?" Awoniyi (2021) found that 50% of the interviewees claimed that a lack of knowledge about the usefulness of the mathematics topics demotivated their learning of the subject. Consequently, students do not see the value or relevance of mathematics' topics to their daily lives or future careers; thus, they are not engaged with the subject. This finding aligned with the position of Anderson and Kriesler (2018) that one way to increase students' commitment to mathematics is by making connections between the subject and real-life applications.

Mathematics contributes to a variety of fields such as economics, engineering, art, natural science, etcetera. Several studies (e.g., Connect et al., 2018; Gebremichael, 2019; Fitzmaurice et al., 2021) have been conducted to determine the mathematics topics that are most relevant to different programmes of study. For example, Flegg et al. (2012) findings on the relevance of mathematics in engineering revealed that differentiation and integration, statistics, percentages, and probability were identified as the most important mathematics topics in the engineering programme. Awoniyi and Ogbonnaya (2022) and Ogbonnaya and Awoniyi (2021) conducted studies focusing on the relevance of senior high school mathematics to student and practising nurses in the Cape Coast Metropolis. Their study revealed that statistics, percentages, mensuration, ratios, and proportions were the most applicable mathematics topics to the nursing programme. Furthermore, the nursing profession considered statistics to be the most relevant mathematics topic.

However, there is a scarcity of information regarding the relevance of mathematics topics in the senior high school curriculum to home economics students' programmes of study. Most importantly, there is a need to air students' views on this discourse. When educators listen to students' voices and use them to co-create the learning environment, students not only feel they are an integral part of a learning community or that they matter and that they have something of value to offer (Fielding, 2007, 2012), but students' perspectives are crucial in understanding and providing valuable insights for educators, helping them tailor their teaching strategies to better meet students' needs (Børhaug &

Weyringer, 2019; Caetano et al., 2020; Frison & Melacarne, 2017; Gillett-Swan & Baroutsis, 2024). Valued student voices can cultivate a sense of belonging and respect, thereby promoting inclusivity and a supportive environment. Engaging students in decision-making fosters the development of crucial communication, critical thinking, and collaboration skills. These skills can translate into empowerment and confidence. Thus, engaging them in how they perceive the relevance of mathematics to their future careers, which can differ from teachers' views, may provide an opportunity for improved curriculum and output.

In other words, previous studies have extensively explored the relevance of mathematics to various fields such as engineering, nursing, and science programmes (e.g., Flegg et al., 2012; Ogbonnaya & Awoniyi, 2021). However, there is a dearth of research specifically examining the relevance of mathematics topics to home economics students. This study fills the gap in the literature by focusing on the unique needs and perspectives of home economics students. Secondly, while many studies have investigated the relevance of mathematics from the educators' or curriculum developers' perspectives, there is limited research that captures the students' views on this matter. This study emphasises the importance of student voices in understanding which mathematics topics they find most relevant to their academic and future career needs (Børhaug & Weyringer, 2019; Fielding, 2012). Finally, the study emphasises the practical applications of mathematical topics such as statistics, rate and proportion, percentages, and mensuration in the field of home economics. This focus on practical applications is crucial for aligning the curriculum with real-world needs and ensuring that students are well-prepared for their future careers. This justify an investigation into the senior high school mathematics topics that home economics students believe are most relevant to their academic programme and future careers. The study was guided by the research question: What mathematics topics do senior high school students specialising in home economics in Cape Coast Metropolis, Ghana, perceive as most relevant to their academic and future career needs?

3. Research method

An explanatory sequential mixed-methods design was employed for the study, which was carried out in the Cape Coast Metropolis. Based on the authors' teaching experience, they have observed a pattern of poor performance in mathematics among home economics students in the Cape Coast Metropolis. The authors' direct interactions with mathematics teachers within the metropolis have further affirmed the challenges faced by home economics students, highlighting their struggles compared to students in other programmes of study. The Cape Coast Metropolitan is one of the 260 Metropolitan, Municipal, and District Assemblies (MMDAs) in Ghana and forms part of the 22 MMDAs in the Central Region. The Cape Coast Metropolitan Area is known to be one of the oldest districts in Ghana, with its administrative capital being Cape Coast.

3.1. Instruments

The questionnaire used in this study was adapted from Gebremichael's (2019) Relevance of Mathematics Scale, a validated instrument that ensures reliability and relevance. It was multi-dimensional and organised into six sections: A, B, C, D, E, and F. The first section focused on the demographic data. The items covered basic personal and background information on the respondents, such as sex, age, school, and class. The second section centred on the attitude of home economics students towards mathematics at the senior high school. The third section concentrated on the relevance of home economics students' prior experiences with mathematics. The fourth section focused on the role mathematics plays in the lives of students studying home economics outside of school. The fifth section addressed the importance mathematics plays in the lives of home economics students and their school experiences. The sixth section was focused on the senior high school mathematics topics that home economics students perceived to be most relevant to their programme.

Although sections B through E utilised a Likert Scale to measure responses, these sections were not the focus of this study. For this study, only Sections A (demographic data) and F (perceived relevant mathematics topics) were utilised. Section A included 4 questions that focused on demographic data such as sex, age, school, and class. Section F, instead of using a Likert Scale, respondents were asked to tick as many mathematics topics as they perceived to be most relevant to their home economics academic and future career needs.

To ensure the credibility of the research results, several steps were taken. Experts in the mathematics education field, including lecturers from other institutions, critiqued both the adapted questionnaire and the interview guide. One of the issues raised is the fact that Form 2 and Form 3 (Grades 11 and 12) covered different numbers of topics. Listing all the topics in the mathematics curriculum would disadvantage certain topics, as Form 2 (Grade 11) students would not have the ability to make informed choices about those topics they have not yet explored. Therefore, the pilot study led to the decision to remove the exclusive Form 3 (Grade 12) topics from the list, ensuring equity for all topics. Another option would be to engage only Form 3 (Grade 12) in the study, but the researchers opted for the first option. Hence, a peer review team assessed the validity of the questionnaire.

3.2. Pilot testing

The researchers submitted the research documents to the Institutional Review Board of the University of Cape Coast for approval before commencing data collection in the field. Consequently, the questionnaire was pretested to determine its reliability and to ensure the survey items' accurate interpretation on 70 students (Forms 2 and 3) in one of the senior high schools since the students in that school exhibit similar characteristics to those of the participants from the three selected senior high schools in terms of their entry behaviour and age. The 70 students were chosen because they constituted 25% of the sample indicated for the main study. A pilot study should have a sample size of 25% of the main study's sample size. For the validity and reliability of the semi-structured interview guide, the trustworthiness of the instrument was determined according to the terms proposed by Lincoln and Guba (1985), such as credibility, transferability, dependability, and confirmability.

Feedback from the pre-test was used to refine the list of topics and interview questions. For example, two topics not yet covered by the Form 2 students: Construction and Logical reasoning, were removed from the list to ensure that every topic had an equal opportunity of being selected. The study combined quantitative data from the questionnaire with qualitative data from a self-developed semi-structured interview guide. The quantitative data, which was analysed using frequency counts and percentages of the chosen topics, were compared with the qualitative interview responses, which were thematically analysed. Hence, triangulation was ensured. This approach allowed for a deeper exploration of the students' perspectives. By comparing the quantitative and qualitative data, the study was able to validate and cross-check the results, thereby enhancing the overall credibility of the findings.

3.3. Population, sample size and sampling techniques

A multi-stage sampling technique was used to select the sample from the population for the study. Seven schools out of the 10 public senior high schools in Cape Coast Metropolis offer the home economics programme. Using the RAND BETWEEN function in Microsoft Excel 2016, three schools were selected from the seven schools offering the home economics programme in the Cape Coast Metropolis using a simple random sampling technique. The estimated population of Form 2 and Form 3 students (Grade 11 and 12) from the three selected schools was 330. Because the second- and third-year students (Grade 11 and Grade

12) have been exposed to most of the mathematics curriculum's content through their two-to three-year learning, the authors selected them for the study. The authors randomly selected 286 students from the total of 330, using Krejcie and Morgan's (1970) table of sample size. Krejcie and Morgan's (1970) table of sample size is an important research tool that gives a simple way to estimate the proper sample size for a specific population. It avoids the need for complex calculations and guarantees that the sample is representative of the population, which is crucial for the validity and reliability of the study's findings (Kharuddin et al., 2020).

This approach ensured that each individual in the population had an equal chance of being included in the sample (Noor et al., 2022; Stockemer et al., 2019). The data collection occurred in January 2022. To avoid disrupting students' routine school activities, the questionnaires were administered outside regular school hours, during their free period. Afterwards, simple random sampling technique was used to select six participants for the semi-structured focus group interviews within each selected school (Creswell & Creswell, 2018). Table 1 present data on the participating schools in the Cape Coast Metropolis and the sample sizes.

Before the data collection date, the researcher visited the schools that participated in the study to establish rapport, seek approval, and explain the purpose and significance of the study. Thus, informed consent was obtained before their participation and 286 questionnaires were distributed to the respondents by the researcher within three weeks. A total of 277 valid questionnaires remained after data cleansing, thereby giving a response rate of 97%. Percentages and frequency counts were used to analyse the research question, while thematic analysis was used to analyse the interview data.

To maintain anonymity, respondents were not required to provide their names on the instrument, and participation in the study was entirely voluntary. The researchers carried out the analysis, interpretation, and presentation of results objectively, minimizing bias to the best of their ability. The results of the quantitative phase were utilised to identify interview candidates for the second phase of the study. In the qualitative phase, pseudonyms were used to represent the interviewed respondents, aligning with the University of Cape Coast's code of conduct for research activities, which was strictly followed throughout the study. Data gathered from the respondents was kept confidential and not shared with any other party.

The participants in the study were Grade 11 and 12 students, aged between 15 and 17 years. As minors, they required parental or guardian consent to participate in the research. However, in alignment with ethical protocols, informed consent was obtained through the headteacher of the participating school. The headteacher, acting in loco parentis (in the place of parents), gave permission on behalf of the students, as is customary for educational research involving minors in this context. Besides securing the headteacher's consent, the research team led an information session where they thoroughly explained the study's purpose, procedures, and voluntary nature to the participants. They assured the students of confidentiality, anonymity, and their right to withdraw from the study at any time without any consequences. The University of Cape Coast supervised the study and upheld its ethical standards for research involving human participants. The university's Institutional Review Board (IRB) granted ethical clearance.

Table 1
Participating schools in Cape Coast Metropolis.

Name of Schools	A		B		C		Total
Level	SHS 2	SHS 3	SHS 2	SHS 3	SHS 2	SHS 3	
Population	40	37	59	66	67	59	328
Sample size (required)	36	34	51	57	57	51	286
Sample Size (collected)	34	33	50	55	56	49	277
Total	**110**	**104**	**160**	**178**	**180**	**159**	

4. Results

The initial presentation of demographic characteristics, including age, gender, and class, was undertaken to systematically organise and convey the study's details.

4.1. Demographic features of the respondents

The data reveals a significant gender imbalance in the study, with 260 female students compared to only 17 males. This aligns with the findings of Laitala and Klepp (2018), indicating a predominant presence of females in areas such as clothing design, cooking, and crafts. Furthermore, the study uncovered that 191 participants fell within the age range of 14–17 years, and the majority, comprising 188 students, were in Form 2 (Grade 11), constituting the highest percentage of participants in the research.

4.2. Perceived relevant SHS mathematics topics to home economics programme of study

The study's findings from the quantitative data revealed that 224 (81%) students identified ratio and rate, percentages, mensuration, and statistics as the most perceived relevant mathematics topics to senior high school home economics programme of study, as presented in Table 2.

4.3. Interview

The largest proportion (224) of the research participants identified four topics as most relevant to the home economics programme. Participants were selected based on the codes provided on the questionnaires, and two students were randomly selected and located at their respective schools. A total of six students were selected for the interview phase.

Three focus group interviews were conducted, each comprising two students—one from SHS 2 and one from SHS 3—from the same school. Therefore, for the three schools involved, a total of three interviews were conducted, with each interview consisting of two students representing different senior high school levels. The students were probed on the

Table 2
Senior high school mathematics topics.

Mathematics Topics	Frequency	Percent	Interpretation
Real number system	169	61.0	Less Perceived
Simultaneous linear equations	167	60.3	Less Perceived
Percentages	**224**	**80.9**	**Most Perceived**
Linear equations and inequalities	163	41.0	Less Perceived
Algebraic expressions	159	57.4	Less Perceived
Number bases	153	55.2	Less Perceived
Statistics	**224**	**80.9**	**Most Perceived**
Indices and logarithms	129	46.6	Less Perceived
Variations	128	46.2	Less Perceived
Modular arithmetic	126	45.5	Less Perceived
Surds	122	44.0	Less Perceived
Relations and functions	116	41.9	Less Perceived
Plane geometry	111	40.1	Less Perceived
Rates and ratios/proportion	**224**	**80.9**	**Most Perceived**
Quadratic functions	99	35.7	Less Perceived
Bearings and vectors in a plane	93	33.6	Less Perceived
Mensuration	**224**	**80.9**	**Most Perceived**
Rigid motion II and enlargement	83	30.0	Less Perceived
Sets and operations on sets	78	28.2	Less Perceived
Sequence and series	77	27.8	Less Perceived
Trigonometry	54	19.5	Less Perceived

Source: Fieldwork, 2022.

senior high school mathematics topics they deemed most relevant to their programme of study and the perceived relevance of those topics to their future careers. Inductive analysis revealed recurring themes such as "mensuration," "rate and proportion," "statistics," and "percentages" across the dataset. Participants consistently expressed that statistics, rate and proportion, mensuration, and percentages were the most relevant senior high school mathematics topics to their programme of study. Therefore, these topics, outlined in Table 3, were identified as crucial for aiding students in understanding the home economics programme of study. The students were prompted to illustrate the connection between those topics and home economics as a programme of study. The participants were coded as P_{21}, $P_{31,}$ P_{22}, $P_{32,}$ P_{23}, $P_{33.}$ With P_{21} representing participant in Form 2, School 1; P_{31} is participant in Form 3, school 1; P_{22} is participant in Form 2, school 2; P_{32} is participant in Form 3, school 2; P_{23} is participant in Form 2, school 3, P_{33} is participant in Form 3, school 3. Table 3 presents excerpts from the interviews showcasing this linkage.

5. Discussions

The research question was to determine the senior high school mathematics topics that home economics students perceived to be most relevant to their programme of study and their future careers. This was done using quantitative design. The finding indicates that ratio and rate, percentages, mensuration, and statistics are the most relevant topics to home economics programme. A further investigation was conducted through a focus group interview (qualitative) to examine which senior high school mathematics topics students perceive to be most relevant to their programme of study and how relevant the topics they have selected are to their future careers. The results from the interview showed that home economics students identify ratio and rate, percentages, mensuration, and statistics as the most perceived relevant mathematics topics to their programme of study in the senior high school. Thus, mathematics topics such as ratio and rate, percentages, mensuration, and statistics play a significant role in home economics students' programme of study. Thus, the results from the interview supported the results from the quantitative results. This implies that students may not realise the importance of other mathematical topics for their academic and professional development. For example, students might not immediately appreciate topics like algebra, geometry, and trigonometry, which are fundamental for developing logical reasoning and problem-solving skills (Chytas et al., 2024), but they are essential for a well-rounded education.

The role of rate, ratio and proportion as demonstrated in calculations and measurements was emphasised. For instance, precise measurements are essential in recipes to ensure accurate ingredient quantities, enhancing the quality of baked goods or dishes. One student, $P_{21,}$ highlighted, "*Mathematics helps us accurately measure ingredients, ensuring our recipes turn out perfectly every time*". Furthermore, rate, ratio and proportion play significant roles in careers related to home economics, such as culinary arts or interior design. Students emphasised its importance in recipe scaling to cater to different serving sizes or in calculating fabric quantities for sewing projects. P_{31} explained, "*Mathematics (Mensuration) is vital in scaling recipes up or down to accommodate different group sizes, ensuring no food goes to waste*".

One important use of statistics for home economics students, whether they are nutritionists or dressmakers, is in analysing trends and patterns in consumer preferences. By utilising statistical data, they can better understand the demands and preferences of their target audience. For nutritionists, this could involve analysing dietary trends to develop tailored meal plans or identify nutritional deficiencies prevalent in specific demographics. For dressmakers, statistics can help in predicting fashion trends, determining popular styles, colours, and sizes, thus guiding their design and production decisions to meet customer demand effectively. For example, P_{22} highlighted that, "*Statistics helps to know which dress or style is in vogue. I will produce only those styles that customer*

Table 3
Excerpts from interview responses on SHS relevant mathematics topics.

Examples of interview responses	Emergent theme
P 21 *Statistics- let's say you are selling, pie and cake at the end of the month you want to know the number of people who bought pie and cake, then you will need the knowledge of statistics …* ***P 31*** *… different fruits and vegetables come out on the market in different seasons. Statistics helps decide nutritional content of different recipes when planning meal. For example, guava and mangoes come out in rainy season, but pawpaw pineapples and bananas always there … so I'll use seasonal fruits and vegetables and convince customers to choose recipes that use fruits in season.* ***P 22*** *Statistics helps to know which dress or style is in vogue. I will produce only those styles that customer will buy. Statistics also help me know which size people will buy more so I produce.* ***P 32*** *I use statistics to budget for what I will spend on food materials and add my profit also … the customer will pay for everything.* ***P 23*** *Statistics will help me compare the weights and prices of bottled items in supermarket before I make my choice on which one to buy.* ***P 33*** *Rate and proportion- eeerh for instance when preparing cake we have a fixed measurement, let's say 1:1:2, so whatever quantity, you take butter you take the same quantity for sugar and double it for flour so it a fixed measurement …*	*"Statistics"* *"Rate and proportion"*
P 21 *… you see anything we use in the kitchen there is a measurement on it … The ratio and proportion help to understand everything …* ***P 32*** *… I use ratio and proportion to ensures accurate ingredient measurements for different number of servings.* ***P 21*** *To maintain balance proportion in diet planning, I need ratio and proportion so that the meal will taste nice and bring wellness.* ***P 31*** *I learn ratio and proportion to calculate the cost of ingredients for a recipe so that I can have a cost-effective meal preparation …* ***P 22*** *When planning and designing interior spaces such as furniture arrangement, ratio and proportion is good … ratio and proportion too apply to the conversion. I said you have to know the ratio and the proportion of items that you want to use …* ***P 21*** *Percentages- some of the products needed to complete a meal are in percentages which you will need maths to understand …* *I can calculate the percentage of the total cost represented by each ingredient in a recipe …* ***P 21*** *… Percentages is useful to adjust ingredient quantities.* ***P 22*** *Percentages help to calculate the proportion of different materials needed for a project.* ***P 32*** *To optimize resource use and minimizing wastages, percentages is very good …* ***P 22*** *… ensures a balanced and well-designed interior so that lighting balance the colour of the paint used …* ***P 23*** *Percentage will help me share money for different categories of expenses so that everything is bought …* ***P 32*** *Percentages, the knowledge of percentages helps or teaches us how to read labels on products.* ***P 33*** *the knowledge of percentages helps or teaches us how to read labels on products, …for example, the ingredient given in percentages let say when you take a biscuit, there is 5%, 6% this … flour, sugar, salt, so you really know what went into the product.*	*"Percentages"*
P 21*: Mensuration-how to convert from one quantity to another, for instance, kg to g; pounds to eerh kilogram, it helps because sometimes you see what you want to do but the quantity is in grams and you want to use pounds … In general, "Mathematics helps us accurately measure ingredients, ensuring our recipes turn out perfectly every time".* ***P 33*** *… use mensuration to assess physical dimensions, weights, or volumes of resources on a scale.* ***P 23*** *Mensuration- for example, I am supposed to sew a dress for someone, everything is in unit of measurement. So, I need to know and understand measurement that I will use. That I will learn here in mathematics …* ***P 31*** *calculate ingredient quantities, to be sure meals are prepared to be enough for people. Mensuration, a subset of mathematics is vital in scaling recipes up or down to*	*"Mensuration".*

(*continued on next page*)

Table 3 (*continued*)

Examples of interview responses	Emergent theme
accommodate different group sizes, ensuring no food goes to waste". ***P*** $_{22}$ *In clothing design and textiles, we can take body measurements correctly.* ***P*** $_{23}$ *To measure room dimensions, furniture sizes, and positioning of furniture, yes, we will use mensuration …* ***P*** $_{21}$ *… when doing shopping also, we think of mensuration …*	

Source: Fieldwork, 2022.

will buy. Statistics also help me know which size people will buy more so I produce. Another P_{31} emphasised that:

> different fruits and vegetables come out on the market in different seasons. Statistics helps decide nutritional content of different recipes when planning meal. For example, guava and mangoes come out in rainy season, but pawpaw pineapples and bananas always there … so I'll use seasonal fruits and vegetables and convince customers to choose recipes that use fruits in season.

Critical thinking abilities are developed through mathematics and are essential for solving problems in home economics. For example, understanding percentages aids in calculating discounts while shopping for food stuff, optimising budget management, etc. P_{31} noted, "*Mathematics enables us to make informed decisions while shopping, ensuring we get the best value for our money"*.

Mensuration is an important concept in mathematics, and it is integral to designing and planning aspects of home economics projects. For instance, understanding geometry aids in measuring and cutting fabric accurately for sewing projects or in calculating surface areas for wallpapering. P_{22} elaborated, "*Mathematics helps us calculate fabric dimensions precisely, ensuring we have just the right amount for our sewing projects*."

P_{23} indicated, "*To measure room dimensions, furniture sizes, and positioning of furniture, yes, we will use mensuration …"*and P_{21} corroborated this assertion saying … *when doing shopping also, we think of mensuration …"*

Students apply various mathematical concepts in home economics tasks. For instance, understanding fractions is essential for adjusting recipe quantities, while knowledge of percentages helps in budgeting for household expenses. P_{31} mentioned, "*We use mathematics every day in home economics, whether it's adjusting recipes or calculating discounts while shopping*. P_{21} explained, "*Percentages is useful to adjust ingredient quantities.* This position was corroborated by P_{22} that "*Percentages help to calculate the proportion of different materials needed for a project"*.

The interviews provided deeper insights into the students' perceptions of the relevance of various mathematics topics. They allowed students to articulate their thoughts and experiences in their own words, providing rich qualitative data that complemented the quantitative findings. The data supported the quantitative results, reinforcing the findings that topics like ratio and rate, percentages, mensuration, and statistics are perceived as most relevant by home economics students. This triangulation of data enhanced the credibility and reliability of the study's conclusions. The interviews helped contextualise the quantitative data by providing specific examples of how students use mathematics in their home economics studies and daily lives. This contextual understanding is crucial for developing targeted educational strategies.

The findings from both the quantitative and qualitative data of this study stated that the most perceived relevant mathematics topics to the student's programme of study were statistics, percentages, mensuration, as well as ratio and rate. The findings had similarities with the results of Ogbonnaya and Awoniyi (2021). They conducted a study on pre- and in-service nurses to determine which mathematics topics are considered relevant to the nursing profession. A possible explanation for the similarities between the two studies may be due to the similarities in the characteristics of the respondents in both studies.

Nurses and home economists often need to analyse data related to patient care, health outcomes, nutritional intake, or household management. Statistical analysis helps them interpret this data accurately to make informed decisions. Nurses and home economists may need to budget resources, whether it is medical supplies in a healthcare setting or foodstuffs and household expenses in home economics. Understanding percentages, ratios, and rates helps them manage budgets efficiently. Nurses and home economists often educate patients or clients about various health or lifestyle-related topics. Using percentages, ratios, and rates helps them communicate information effectively, such as explaining medication dosages, nutritional recommendations, or household budgeting tips. Both professions prioritise quality improvement initiatives. Although the data were collected from the same metropolis, they were collected five years apart and from two different professions. In summary, while all students recognise the importance of mathematics in home economics, their attitudes towards it vary. Many appreciate its practical applications in tasks like recipe scaling and budgeting, while some find certain mathematical concepts challenging and overwhelming. Nonetheless, understanding and applying mathematics is crucial for success in home economics programmes, enhancing students' abilities to manage household tasks effectively.

Students tend to favour mathematics topics that they perceive as directly applicable to their daily lives and future careers. For instance, real-world contexts such as budgeting, recipe adjustments, and data analysis often view topics like statistics, percentages, and mensuration as highly relevant (Fitzmaurice et al., 2021). When students see the practical applications of these topics, they are more likely to engage with and appreciate them. People often appreciate mathematics for its clear structure and definitive answers. Unlike subjects that may have subjective interpretations, mathematics provides a sense of certainty and clarity, which can be satisfying for students (LearnPar, 2024). This clarity helps students build confidence in their problem-solving abilities. The use of visual aids, graphs, and real-world examples can enhance students' understanding and enjoyment of mathematics. These tools help students make connections between abstract concepts and tangible applications, thereby improving their engagement and interest (Khan Academy, 2024).

This implies that students who develop a strong liking for and proficiency in relevant mathematics topics are better prepared for careers that require these skills. For example, proficiency in statistics and data analysis is crucial for careers in fields such as economics, engineering, and health sciences (Bohrnstedt et al., 2020). This preparedness can lead to better job performance and career advancement opportunities. A positive attitude towards specific mathematics topics can lead to higher academic achievement. Students who enjoy and excel in mathematics are more likely to pursue advanced studies in STEM fields, which are associated with high-demand and well-paying careers (Wang, 2013). This could have long-term benefits for their professional and financial stability. Engaging with mathematics topics that students find intriguing can enhance their critical thinking and problem-solving skills. These skills are not only valuable in academic settings but also in everyday decision-making and professional contexts (Whitney-Smith et al., 2023). For instance, the ability to analyse data and make informed decisions is crucial in many careers, from business to healthcare. When students like certain mathematics materials, they are more motivated to engage with the subject and persist through challenges. This increased engagement can lead to a deeper understanding of mathematical concepts and a greater willingness to tackle complex problems (EdReports, 2023). This persistence and resilience are valuable traits in both academic and professional settings.

6. Conclusion

Students are the ones directly engaged with the curriculum and can provide firsthand insights into which topics they find most relevant and useful. Thus, understanding what students find relevant can help

educators design more engaging and motivating lessons.

The study adds to the existing literature by providing empirical evidence on the specific mathematics topics that are most beneficial for home economics students. It highlights the practical applications of these topics, which can inform future research and educational practices. This study offers significant insights into the mathematics topics that home economics students find most relevant, enabling teachers to customise their teaching methods and educators to better cater to students' needs. However, the study also emphasises the need for educators to highlight the importance of other mathematical topics that students might overlook. This dual approach ensures that students are not only engaged but also receive a comprehensive education that prepares them for various challenges in their careers and daily lives.

Curriculum developers and policy makers can use the practical applications of the topics to better understand and align the curriculum with real-world applications. The study's highlighted topics may assist all stakeholders in concentrating on skills essential for future careers in home economics-related fields. The findings suggest that while it is important to align the curriculum with students' perceived needs, it is equally crucial to educate students about the relevance of other mathematical topics. For instance, algebra and geometry are not only foundational for advanced mathematics but also for fields like engineering, architecture, and computer science. Educators can bridge this gap by integrating these topics into practical applications relevant to home economics, such as using algebra for budgeting and financial planning or geometry for interior design and spatial planning.

The selective liking of certain mathematics topics can influence students' career choices and preparedness for future challenges. By ensuring that students appreciate the full spectrum of mathematical topics, educators can help them develop a versatile skill set that enhances their career prospects and adaptability in various fields. This comprehensive approach to mathematics education can lead to better academic performance, higher engagement, and greater career readiness. This study's findings bridge the gap between theoretical mathematics and its application in the field of home economics. It emphasises the importance of mathematics in daily and professional activities within the culinary field. The research highlights the importance of integrating relevant mathematics topics such as ratio and rate, percentages, mensuration, and statistics into the curriculum. For economics students, these topics are critical because they underpin many economic theories and quantitative methods used in higher education. Emphasising these areas can enhance students' analytical skills, enabling them to better understand and apply economic concepts, perform data analysis, and make informed decisions in their future careers.

6.1. Limitations of the study

First, the study's sample size was limited to 286 students from three senior high schools, which may have under-represented the different opinions of all home economics students in the region. Furthermore, the study focused just on students in grades 11 and 12, ignoring those in grades 10 who may have different views. Second, the study's geographical scope was limited to the Cape Coast Metropolis, which may limit the findings' applicability to other places in Ghana. The distinct qualities of the chosen schools and their students may not reflect the general population. Third, the data collection methods used self-reported questionnaires and interviews, which might be influenced by social desirability and recall bias. Finally, the removal of specific mathematics topics from the study due to variations in curriculum coverage between grades 11 and 12 may have impacted the findings' comprehensiveness. The study may have ignored certain key aspects, influencing its overall conclusions.

6.2. Suggestion for future research

Future research could involve a larger and more diverse sample of students from various regions of Ghana to improve the findings' generalisability. Students in grades 10 through 12 might provide a more thorough understanding of the relevant mathematics topics at the senior high school level. Longitudinal studies that examine the influence of identified relevant mathematics themes on students' academic performance and career success over time would provide more insight into the long-term benefits of aligning the curriculum with students' needs. Comparing home economics students' judgements of the relevance of mathematics themes to those of students in other disciplines (e.g., science, arts) may reveal specific requirements and commonalities, resulting in more targeted curriculum creation.

Curriculum developers and teachers could obtain fact-based recommendations by employing experimental or quasi-experimental designs to investigate how well the identified relevant math topics operate when added to the home economics curriculum. Incorporating mathematics and home economics teachers' thoughts on the relevance and application of mathematics themes into their teaching could provide significant insights into potential gaps and areas for development in instructional approaches. Investigating the role of technology in teaching and learning the selected relevant mathematics topics may yield novel techniques for increasing student engagement and knowledge. A future study might concentrate on strategies for increasing student engagement and motivation in mathematics education, particularly for home economics students, by connecting to real-life applications and job relevance. Similar research in diverse cultural contexts could provide a broader view of the relevance of mathematics topics and aid in identifying both universally essential topics and those topics that are culturally unique according to the geographical needs and demands of people.

CRediT authorship contribution statement

Joshua Kai Dossey: Writing – original draft, Resources, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Kofi Ayebi-Arthur:** Supervision, Methodology, Conceptualization. **Florence C. Awoniyi:** Writing – review & editing, Supervision, Methodology, Formal analysis.

Ethical clearance

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Declaration of competing interest

On behalf of myself, Florence Christianah Awoniyi and the co-authors of the manuscript titled "Uncovering Relevant Mathematics Topics for Home Economics: Senior High School Students' views in Cape Coast, Ghana" I declare that the manuscript has not been published previously, that it is not under consideration for publication elsewhere, that its publication is approved by all authors and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder.

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Appendix A. Supplementary data

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