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ICOMER 2024

Moderator: Mohamad Waluyo, M. Sc
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RULES PARALLEL PRESENTATION

The 4th International Conference on Mathematics and Learning Research (ICOMER) 2024

Zoom meeting parallel presentation will be open at 12.30 pm (Jakarta time GMT+7). The link Zoom to the parallel session presentation can be accessed on: https://ums-ac-id.zoom.us/j/4046231755?pwd=aTJ1NUlKbnBxZ2NTalNVSitieUErZz09&omn=94774964614

Meeting ID: 404 623 1755
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The rules of the parallel presentation are as follows:

1. Each room has a moderator who helps to organize the presentations
2. The presentation can start from the participant who arrived first or by mutual agreement between the moderator and the presenters
3. Presentation duration must be between 10-15 minutes include QnA
4. The content of the PowerPoint must be written in English
5. The presentation is highly recommended to use English
6. The Presentation must use ICOMER 2024 template presentation that can be downloaded in here

After presentation, please fill the link: ums.id/ParallelICOMER2024 to give confirmation about presenter, title, etc for information in certificate.

Regards,
The Committee of ICOMER 2024

INTERNATIONAL CONFERENCE ON MATHEMATICS AND LEARNING RESEARCH

MATHEMATICS EDUCATION DEPARTMENT
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Surakarta, 21th September 2024

No : 036/ICOMER/D.3-III/IX/2024
Subject : Invitation Letter
Attachment : Conference Rundown

Dear All Presenters,
We are pleased to invite you to the "International Conference on Mathematics and Learning Research (ICOMER) IV" scheduled on,

Date : September 25th, 2024

Time : 07.30 – 12.15 (Jakarta time GMT+7)

Place : Universitas Muhammadiyah Surakarta, Indonesia (Zoom Meeting)

Link Zoom : https://ums-acid.zoom.us/j/4046231755?pwd=aTJ1NUlKbnBxZ2NTalNVSitieUErZz09&omn=94774964614
Meeting ID: 404 623 1755
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The Conference will be on the following themes:

"**Fostering Mathematical Thinking for Sustainable Development Goals: Empowering Minds, Transforming Futures**".

Please join ICOMER 2024 **WhatsApp Group**, because all of the information will be announced in the **WhatsApp Group 2024**.

For you who do not upload the payment proof yet, please upload it in the Payment Proof Upload link: **Payment link**.

We look forward to your positive confirmation.

Sincerely,

Rini Setyaningsih, M. Pd
Conference Chair
Mathematics Education Dept
Universitas Muhammadiyah Surakarta – Indonesia

RUNDOWN
Wednesday, September 25th 2024

Time	Activity	
07.30 – 08.00	Participant Joining Zoom	
08.00 – 08.30	Opening by MC - Recitation - Singing Indonesia Raya and Sang Surya - Welcome speech from chairman of ICOMER 2024 - Welcome speech from Rector of Universitas Muhammadiyah Surakarta	
08.30 – 09.30 (60")	**Prof. Jodie Hunter** (Massey University - New Zealand)	Moderator: Naufal Ishartono, Ph.D
09.30 – 10.00	Question and Answer Session	
10.00 – 10.45 (45")	**Prof. Dr. Wahyu Hidayat, M.Pd.** (IKIP Siliwangi - Indonesia)	Moderator: Dr. Muhammad Noor Kholid, M.Pd
10.45 – 11.30 (45")	**Assoc. Prof. Dr. Masduki, M.Si.** (Universitas Muhammadiyah Surakarta - Indonesia)	Moderator: Dr. Muhammad Noor Kholid, M.Pd
11.30 – 12.00	Question and Answer Session	
12.00 – 12.15	Closing by MC	

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International Conference on Mathematics and Learning Research (ICOMER)

Fostering Mathematical Thinking for Sustainable Development Goals: Empowering Minds, Transforming Futures

Editors:
Mohamad Waluyo, Naufal Ishartono

Surakarta, November 11st 2024

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Surakarta, November 11st 2024

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PREFACE

Assalamu'alaikum Warahmatullahi Wabarakatuh

Alhamdulillah, we give thanks to Allah SWT for His grace, blessings, and guidance, enabling us to successfully organize the 2024 International Conference on Mathematics and Learning Research (ICOMER), hosted by the Mathematics Education Department of Universitas Muhammadiyah Surakarta, Indonesia.

The theme for this year is **"Fostering Mathematical Thinking for Sustainable Development Goals: Empowering Minds, Transforming Futures."** The conference aims to provide a dynamic platform for researchers, educators, and practitioners in the field of mathematics and mathematics education to exchange ideas, share their latest research, and explore innovative approaches to teaching and learning. Through this theme, we emphasize the vital role of mathematical thinking in addressing global issues and contributing to the Sustainable Development Goals (SDGs), aligning our efforts with the global vision for a sustainable and equitable future.

The ICOMER 2024 proceedings include a diverse range of papers presented at the conference, showcasing theoretical studies, empirical research, and practical applications in mathematics education. The collection reflects our commitment to enhancing mathematical literacy, problem-solving skills, and critical thinking to better equip learners for the challenges of the 21st century.

While we strive to ensure the quality of these proceedings, we recognize that there may still be areas for improvement. We warmly invite feedback, suggestions, and constructive criticism to help us enhance our future publications.

We hope this compilation serves as a valuable resource for readers, especially those committed to advancing the fields of mathematics and education. May it inspire further research, collaboration, and innovation, ultimately contributing to the transformative power of education.

Wassalamu'alaikum Warahmatullahi Wabarakatuh.

Chairman
Rini Setyaningsih, M.Pd.

List of Content

STEAM-H to Support Agribusiness Students' Work Skill

Ai Tusi Fatimah[1, a)], Agus Yuniawan Isyanto[2, b)] and Euis Erlin[3, c)]

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Abstract. The study focuses on the importance of work skills for students at Agribusiness Vocational High Schools in meeting the demands of 21st-century competencies. It explores how the STEAM-H (Science, Technology, Engineering, Agriculture, Mathematics, Health) approach can assist in developing these work skills. The research aims to assess students' grasp of the STEAM-H concept and to identify the work skills they acquire through learning that incorporates the STEAM-H approach. This investigation adopts a case study design involving 16 eleventh-grade students from the Agribusiness Vocational High School for Agricultural Product Processing in Ciamis Regency. Data was gathered through initial and final tests to gauge the students' understanding of STEAM-H, as well as through observations and interviews conducted while the students were engaged in a project on chicken wonton processing to evaluate their work skills. The results indicated a significant improvement in students' comprehension of the STEAM-H concept after participating in the learning process. This increased understanding corresponded with the students' work skills, as evidenced by their successful completion of the chicken wonton processing project. The study concludes that the STEAM-H approach holds substantial potential for enhancing students' understanding of mathematics, food security, science, health, and technology concepts relevant to the agribusiness sector while also fostering the development of essential work skills required in the workplace. Wonton production requires a strong interdisciplinary approach. Mathematics, especially computational thinking skills, are crucial in designing an efficient and effective production process. The implication of this study underscores the importance of integrating the STEAM-H approach into the curriculum of Agribusiness Vocational High Schools, thereby preparing students to become competent graduates equipped to confront challenges in the era of Industry 4.0.

INTRODUCTION

The inclusion of STEAM-H (Science, Technology, Engineering, Agriculture, Mathematics, and Health) in agribusiness education is increasingly important for addressing complex real-world problems (1). Research has shown that project-based learning integrated with STEM is effective in enhancing students' entrepreneurial skills in vocational schools (2) and also improves students' engineering skills in crop agribusiness courses (3). To promote entrepreneurship among agribusiness students, educational institutions should prioritize creating experiences through industry partnerships, applied courses, and internships (4). It is noted that students inclined towards entrepreneurship are often male, risk-takers, and have parents involved in production agriculture (4). Agriculture serves as a conceptual and contextual integrator for STEAM-H learning in crop agribusiness schools (1). This initiative aligns with the demands of 21st-century education, which emphasizes science and technology literacy among students (3) and focuses on developing work skills for vocational high school students.

Work skills are important for students of SMK Agribisnis in agricultural product processing. Teamwork activities through work-based learning make a significant contribution to the development of vocational high school students' work skills (5). The curriculum of Agricultural Vocational High Schools is aligned with industry needs, with a focus on competencies required for level two certification in the Indonesian National Qualification Framework (6). In addition, green skills are increasingly important in the labor market, with Agricultural Vocational High Schools students showing fairly good overall green skills but needing improvement in waste

management, communication, and innovation to meet employer demands (7). These studies highlight the importance of industry-aligned practical skills and the need for innovative teaching methods to prepare students for the evolving labor market in agricultural product processing.

The understanding of STEAM-H and work skills when students process chicken wontons are the focus of this study. Chicken wontons are animal products where students of vocational high schools majoring in agricultural processing agribusiness class XI must achieve learning, namely carrying out animal processing production. Through the activity of processing chicken wontons, students are required to understand science, technology, engineering, mathematics, and health. Students will be aware of chicken processing methods that will have an impact on nutritional composition, digestibility, and safety. Steamed chicken showed higher digestibility of essential amino acids compared to other processing methods, with actual digestibility exceeding 90% for most amino acids (8). The superheated steam treatment of chicken thighs and breasts, combined with marination and hot smoking, resulted in high overall acceptance scores and good nutritional composition (9). The processing of these products involves a lot of discipline within the scope of STEAM-H to support work skills.

Research on 21st-century workforce competencies has identified several key skills that are essential for success. Analysis of the O*NET database revealed five key competencies: problem-solving, fluid intelligence, teamwork, achievement/innovation, and communication skills (10). Other opinions, about the supporting competency categories are analytical skills, interpersonal skills, ability to execute, information processing, and capacity to change and learn (11). In addition, there are other opinions about work skill indicators, namely sense-making, social intelligence, novel and adaptive thinking, cross-cultural competency, computational thinking, new-media literacy, transdisciplinarity, design mindset, cognitive load management, and virtual collaboration (11,12). The last indicator offered will be explored in this study. Thus, the main objective of this study is to determine the description of STEAM-H understanding and work skills of students in chicken wonton production.

METODE

This study used a case study method (14). This study was conducted at SMK Agribisnis Pengolahan Hasil Pertanian. A public school in the city of Ciamis, West Java, Indonesia. Participants in this study were 16 eleventh-grade students. Participants were divided into four groups. The flow of this study is illustrated in Figure 1 below.

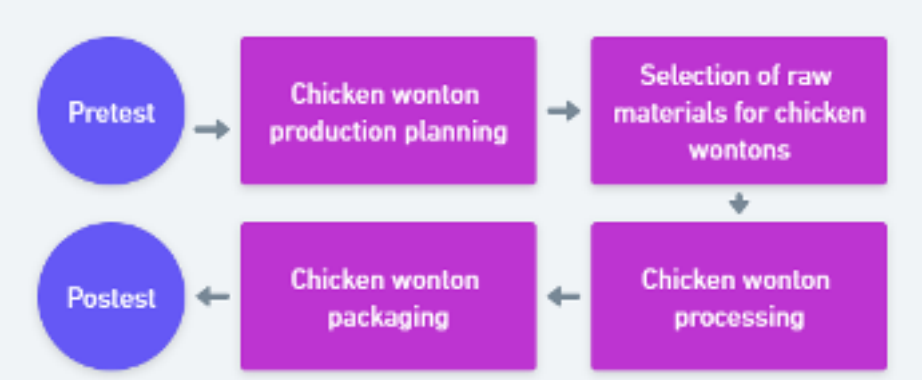

FIGURE 1. Research Flow

During the pretest and posttest, students were given 20 questions covering the subjects of science, technology, engineering, agriculture, mathematics, and health. The agriculture section focused on understanding food security, while mathematics and food security had five questions each. This emphasis on mathematics and agribusiness was due to them being the main subjects, as natural science subjects are not part of the grade eleven curriculum in vocational high schools. Natural and social science subjects are only studied in grade ten. Science and health had three questions each, while technology and engineering had two questions each. The N-Gain formula was used to analyze the results and determine the increase in students' understanding of STEAM-H.

During the chicken wonton production process, students are provided with worksheets. At the planning stage, all students focus on working on worksheets to find information related to the nutrition contained in chicken wontons and their health benefits, engineering carried out on the chicken wonton recipe above, planning the chicken wonton processing flow and the technology used, calculating the estimated cost of wonton ingredients, predicting results and selling prices. At the raw material selection stage, students also measure/weigh. During the processing process, students cut, boil, and do other activities until chicken wontons are ready to be packaged. Observations and interviews were carried out from planning to packaging to determine students' work skills based on ten indicators from. The results of observations and interviews were analyzed to determine the characteristics of students' work skills possessed by students.

RESULTS AND DISCUSSION

The results of this study consist of two major parts, namely STEAM-H understanding and work skills based on the chicken wonton production process. Based on the results of the pretest and posttest, the average understanding of STEAM-H was obtained in the high category. Figure 2 below illustrates the percentage of students' N-Gain categories.

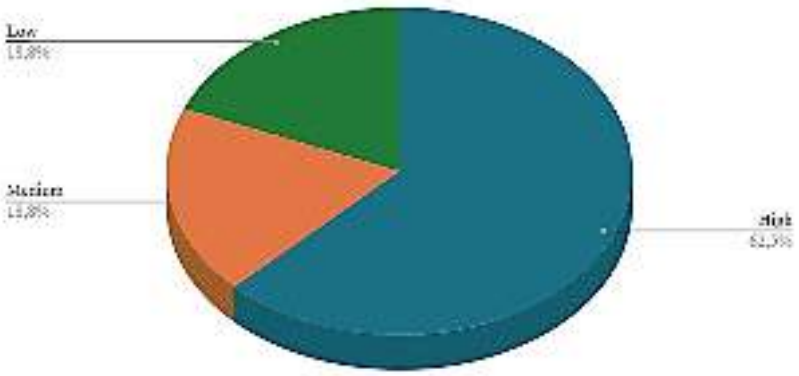

FIGURE 2. Percentage of N-Gain of Students' STEAM-H Understanding

The significant number of students who achieved a high level of understanding in STEAM-H cannot be overlooked, and their success is closely related to their experience in making chicken wontons. Research on STEAM-H in the field of education is still not very common. When we consider integrated learning such as STEM, we find numerous benefits for students engaging in specific projects. Studies indicate that STEM-based projects enhance students' grasp of scientific concepts, improve their problem-solving skills, and boost their motivation (13,14). It has also been observed that STEM-PjBL helps to develop students' scientific process skills, such as questioning, observing, formulating hypotheses, and communicating (15).

STEAM-H understanding can also be identified through observation and interviews related to students' work skills both explicitly and implicitly. The description of work skills consists of nine indicators, where virtual collaboration is not part of the work skills carried out in this project, all of which are carried out by students together in real-time in the same place. Therefore, the results presented only consist of sense-making, social intelligence, novel and adaptive thinking, cross-cultural competency, computational thinking, new-media literacy, transdisciplinarity, design mindset, and cognitive load management.

FIGURE 3. Chicken Wonton Production Process (a) Planning (b) Selection of Raw Materials (c) Material Refining (d) Boiling (e) Seasoning Making (f) Packaging

In this context, sense-making refers to students' ability to connect information, analyze it, and make relevant decisions for the chicken wonton processing project. This skill can be observed when students search for information and develop recipes. For instance, students search for information about the nutritional content of chicken wontons, particularly the protein from chicken meat and its health benefits, such as muscle growth and tissue repair. Specifically, groups 2 and 4 demonstrate sense-making by adjusting the recipe based on their experience. They choose not to use dried cayenne pepper due to familiarity with taste considerations. In contrast, groups 1 and 3 also display sense-making by adding dried cayenne pepper to create a different, spicier taste. This indicates their understanding of the impact of variation in cooking on taste. In process and technology planning, students are able to create a logical and efficient processing flow by considering the sequence of steps, time required for each stage, and the necessary equipment. Students also identify the technology that might be used, such as a blender for grinding meat or a digital scale for accurate ingredient measurement. Moreover, students' understanding of the protein denaturation process demonstrates their ability to relate scientific concepts to cooking practices. They understand that adding ice cubes when grinding meat can help maintain the meat's chewy texture.

The incident, in which groups 1, 2, 3, and 4 proposed alternatives for making wontons, such as creating various wonton shapes and using molds, demonstrates the presence of innovative and forward-thinking among students. The proposal to create various wonton shapes other than the traditional shape shows creativity and a willingness to think outside the box. Students are not only focused on a single shape but are willing to experiment with different designs to produce more interesting products. The suggestion by groups 2 and 4 to use wonton molds reflects forward-thinking in terms of time and efficiency. They recognize that by using tools such as molds, the wonton-making process can be accelerated without compromising on quality.

Sense-making is a critical process in learning, involving students actively connecting, analyzing, and making decisions based on information (16,17). It encompasses gap facing, defining, bridging, and resolution (16). In academic contexts, sense-making differs from everyday experiences and is discipline-specific, requiring teachers to employ various practices to position students as active sense-makers (18). Interactive learning environments, both technology-enhanced and collaborative, play a significant role in facilitating effective sense-making (16,19). Understanding collaborative sense-making processes in discovery-based learning environments can further enhance educational practices (19).

Social intelligence is a person's ability to interact, understand, and build good relationships with others. This ability is very important in various aspects of life, including working together in groups. Social intelligence is the ability to interact, understand, and build relationships with others effectively (20). When students divide tasks into groups, they demonstrate the ability to understand the role of each member and work together to achieve common goals. This shows an awareness of the strengths and weaknesses of individuals in the group. The interactions that occur during the wonton-making process, such as giving and receiving input, demonstrate the student's ability to communicate effectively. They are able to listen to others' opinions, provide constructive feedback, and work together to find the best solution.

Transdisciplinarity is the ability to connect and integrate concepts from various disciplines to solve problems or create new knowledge. Transdisciplinarity is an approach that integrates cross-disciplinary knowledge to solve complex problems and create new insights (21). In the wonton-making activity, students not only use cooking skills but also acquire knowledge from various other disciplines, especially mathematics. Students use mathematics to measure the amount of ingredients needed. They use units of measurement such as grams, milliliters, and tablespoons. Students do simple calculations such as addition to determine the total amount of ingredients needed. Students adjust the amount of ingredients using the concept of proportion. The cooking process involves chemical changes, such as protein denaturation when meat is ground and heated. Students also consider the nutritional value of the ingredients used, such as protein and vitamin content, and pay attention to aspects of food hygiene and sanitation to prevent contamination by microorganisms.

New media literacy refers to a person's ability to search for, evaluate, create, and communicate information using digital technology. This form of literacy includes the ability to access, analyze, evaluate, and create digital content in different contexts (22). Students make use of various digital platforms such as social media, particularly Google, and also rely on information from teachers. This demonstrates their ability to access information from diverse sources. In addition to searching for information, students also evaluate it by comparing information obtained from various sources with their existing knowledge or previous experience in making wontons. This ability to assess the credibility of information is a crucial aspect of new media literacy. Students also create promotional content in the form of templates containing information about their products (wontons), showcasing their ability to produce engaging and informative digital content.

A design mindset is a way of thinking that prioritizes the user in the design process. It involves understanding user needs, pinpointing issues, and creating innovative solutions. The design mindset is a crucial element in innovation and design practice, as it influences behavior and performance (23). Students realized that the most crucial part of the wonton is the filling, demonstrating their understanding of consumer preferences for taste and ingredient quality. The suggestions from groups 2 and 4 to add salt or powdered broth to the filling dough reflect their effort to enhance the taste and quality of the product, showing that students are aware and always seeking

ways to improve their products. Furthermore, students adhere to the planning of the wonton-making process, indicating their understanding of the importance of a clear work plan before production begins.

Cognitive load management refers to a person's ability to organize and manage the information entering their brain in order to focus on the task at hand. Cognitive Load Theory provides a framework for understanding and optimizing mental processing in working memory (24). During the task of making wontons, students were able to focus on the task at hand and were not distracted by irrelevant things. The use of timers and notes helped students manage their time and remember the steps that needed to be taken. These aids reduced the students' cognitive load, allowing them to focus more on the task at hand. Specifically, groups 2 and 4 identified the problem they faced, which was that the dumpling skin was too thin and easily torn. This shows their ability to filter information relevant to the task at hand. Identifying the problem with the dumpling skin shows that students are trying to understand why the problem occurs and find a solution. This is an example of an effort to maximize cognitive function.

Cross-cultural competence is the ability to interact and work with people from different cultural backgrounds. This ability includes understanding different values, customs, and perspectives. Students know that wontons originate from Chinese culture. This demonstrates a basic understanding of the origins of the food and the cultural context in which it originated. Students' knowledge of the health benefits of natural ingredients demonstrates an appreciation for local wisdom and traditional knowledge from different cultures. Many cultures have extensive knowledge of medicinal plants and healthy foods.

Computational thinking is the ability to think logically, systematically, and analytically, and to solve problems using computational concepts. Computational thinking is a cognitive process that involves solving problems using computational concepts (25). It includes skills such as systematic problem-solving, data analysis, algorithmic thinking, abstraction, and recognition. A wonton recipe is a simple algorithm that contains the steps and ingredients needed. Students translate this recipe into concrete actions. Calculating the amount of ingredients needed based on the desired number of servings is a simple example of data-based reasoning. Students perform calculations to ensure that all ingredients are available in sufficient quantities. Measuring ingredients such as flour, water, and meat, and then converting them to smaller units of measurement (e.g., grams or tablespoons) is the process of translating quantitative data into physical actions. Determining the selling price of a product (wontons) involves calculating production costs (raw materials, labor) and determining profit margins. This is another example of data-based reasoning.

The role of mathematics in this chicken wonton-making project turned out to be very crucial and involved various aspects. Computational and interdisciplinary thinking skills are key to solving the challenges that arise. Starting from the raw material preparation stage, the production process, to the final cost calculation, students are invited to apply mathematical concepts directly. For example, in designing a budget, each group must make careful calculations to determine the amount of raw materials needed and the cost of purchasing them. The results are also varied, as seen in Figure 1, where each group has a different cost estimate. This shows that mathematics is not just numbers, but also an effective tool for solving real problems in everyday life.

All descriptions of students' work skills led to the success of the four groups in producing chicken wontons, which is part of the learning outcomes of agricultural processing. STEAM-H knowledge support makes students think creatively, actively, and critically. Learning with the STEAM-H approach is quite promising to be implemented in other learning outcomes such as the production of processed vegetables and spices.

CONCLUSION

This study successfully showed a significant increase in students' understanding of the STEAM-H concept after carrying out the chicken wonton production activity. Through this activity, students not only gain knowledge about science, technology, engineering, and mathematics but also develop various work skills that are relevant to the 21st century. The results of this study also show that the chicken wonton production activity can be an effective medium for developing various student work skills. Students have sense-making abilities, namely being able to connect the information obtained, analyze it, and make relevant decisions. Students have novel and adaptive thinking abilities by demonstrating creativity and the ability to think outside the box in designing products. Students have social intelligence abilities: which are characterized by being able to collaborate well in groups and communicate effectively. Students have transdisciplinarity abilities, namely being able to integrate concepts from various disciplines in solving problems. Students have design mindset abilities by demonstrating the ability to understand user needs and create innovative solutions. Students demonstrate computational thinking abilities by being able to translate data into abstract concepts and perform the necessary calculations. Students have new media literacy abilities by being able to search for, evaluate, and create digital content. The chicken wonton production activity also helps students develop cross-cultural competence through an understanding of the origins of food and the values contained therein.

FIGURE 1. Student Response Examples

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