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Original Research Article

Detecting the interest of undergraduate students : A new way of chemistry education as a basis for instructional development

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ABSTRACT

The achievement of learning targets is largely determined by how learning facilitates the needs of participants. Interest is one of the important points that teachers need to be aware of, especially in higher education environments to produce competent and resilient students (prospective teachers). The purpose of the research was to detect the interests of chemistry education students quantitatively and other themes that related to their lives. The quantitative approach was the method used in the study because it was in line with the data collection technique, namely the questionnaire technique with quantitative analysis. The results showed that the theme interest “everyday life” with the topic of food has the largest percentage, namely 86%, while the least theme was textile dyeing (58.30%) by chemical processes theme. Other additional themes revealed that social media (digital technologies) has 75.50% while teaching & learning and diversity have percentages of 64.70% and 59%, respectively. The conclusion was that detecting elements of interest in students could be supporting data for designing chemistry learning considering the changes in the mindset of the young generation due to digital culture. This research can also be used as a needs analysis in learning because a great interest in learning affects students’ academic performance. Research findings also give be a provision for students when they become teachers so that this research can be used in the school environment.

Introduction

Interest is part of intrinsic motivation that drives someone to be able to pay attention to something intensely and focused (Barke et al., 2012). In their study, Barke et al. (2012) explained that internal motivation is the factor that most influences participants in constructing an understanding of the intervention obtained. Relevant interventions and following participants’ interests facilitate the process of forming scientific mindsets and mental models (Darmiyanti et al., 2017; Sunyono, 2018; Schwedler and Kaldewey, 2020; Ngien and Jiang, 2022). For example, understanding science through a social context such as cultural integration triggers the growth of participant interest (Almubarak et al., 2024). Culture is an interesting context because it is very close to the daily lives of participants so this situation makes it easy for participants to be influenced by intrinsic motivation and has an impact on interests and changes in cognitive structure (Mezirow, 1991; Taylor and Sobel, 2011; Barke et al., 2012) Cultural integration is an important strategy regarding the interest aspect so that teachers have a basis for developing learning designs according to needs (Gagne, 1970; Barke et al., 2012; Corbin Dwyer, 2019; Suja et al., 2020; Tsaparlis, 2021).

In theoretical explanation, interest consists of three questions analyzed by Barke et al. (2012), the first is in which area do students have experiences related to everyday life? The second question is how the surrounding environment influences the character of the participants. meaning that the question is related to the learning environment that greatly influences the understanding of students. Furthermore, what kind of chemical phenomena do students experience that are related to life? These questions illustrate the involvement of interest as important in the teaching process and these questions become a guide for teachers (Barke et al., 2012). Interest can be implemented easily so that students gain significant cognitive progress in understanding the material. For example, participants are interested in discussing synthetic/processed products such as packaged meatballs, packaged drinks, and fast food. By taking the topic of food, teachers can develop food-related projects with the main discussion being the composition of chemical compounds contained in the product. Through topics of interest, participants can investigate the composition of chemical compounds in products and present them in class. Project work can train students' reasoning and problem-solving skills to find new solutions and knowledge from the topics being worked on (Kiernan et al., 2021; Parobek et al., 2021; Vo et al., 2022; Wisudawati et al., 2022). Other topics can also be made into projects in different formats so that the presentation and learning content are more varied.

The example above shows that interest can be used by teachers as a bridge of knowledge to train thinking skills and alternatives in developing chemistry learning. In terms of research ideas, interest is the center of study in research considering the difficulty of participants in achieving learning goals and transforming mental models, especially in higher education environments (Mezirow, 1991; Bucat and Mocerino, 2009; Barke et al., 2012; Almubarak and Saadi, 2023). The main concept of implementing the research is to detect the interests of chemistry education students to find out the description of the most dominant student interests. The detection results obtained become recommendation materials for teachers in designing learning. on the other hand, the description of interests can also be used by students as self-reflection, and can use the same method when working as teachers in a school environment. Detection refers to the analysis process to obtain information about student interests in various themes given. The results of the interest analysis can be used as a basis for decisions on learning concepts that you want to develop, including determining methods, quizzes, assessment formats, and learning actions. By using interest analysis, teachers can more easily understand students' level of understanding because the concept of interest can be integrated into various learning frameworks and attributes.

In chemistry education, the level of understanding refers to the cognitive structure of students towards the material being studied. Problem intervention in learning is a powerful strategy for students to experience cognitive development. According to Tsaparlis (2021), students can use their thinking skills when they are faced with certain problems and things relevant to what they experience. If teachers develop interest-based learning in various themes, then this learning can train students' reasoning and problem-solving skills through the dominant themes of interest (Rodriguez et al., 2020; Wackerly, 2021; Wisudawati et al., 2022; Asmussen et al., 2023). These skills greatly influence students' interpretation abilities in explaining chemical phenomena, especially at the sub-microscopic level (Taber, 2013; Gkitzia et al., 2020; Keiner and Graulich, 2021; Bruce et al., 2022). Practically, interest analysis has a major impact on student's academic performance if teachers naturally design learning according to interests. This conformity makes students transform cognitively and gain meaningful learning experiences. Student development refers to strengthening thinking skills, especially chemical representation skills because this is a fundamental component of understanding chemical materials.

Several studies have found that students tend to use macro abilities in solving problems compared to sub-microscopic abilities so students do not know in depth the material being studied (Schwedler and Kaldewey, 2020; Tsaparlis, 2021; Keiner and Graulich, 2021; Kiernan et al., 2021; Underwood et al., 2021; Kroll and Plath, 2022). Strengthening thinking skills with problem intervention strengthens students' competence in explaining chemical phenomena at the reaction level (Rodriguez et al., 2020; Tsaparlis, 2021; Keiner and Graulich, 2021; Kiernan et al., 2021; Park et al., 2021; Parobek et al., 2021; Wackerly, 2021). Interest analysis can be the key and in the initial stages students experience a transformation in thinking ability so that understanding and scientific mental models grow and issues of misunderstanding can be reduced gradually. The formulation of the research problem is how to describe chemistry education students' interests in the various themes presented.

Methods

The research design uses a survey method using data collection techniques, namely questionnaire techniques (Creswell, 2012). The questionnaire content is in the form of questions with themes and each theme consists of several topics (an explanation of the questionnaire items can be found in the results). Each student may choose more than 1 topic but a maximum of 4 choices. For example, if students choose the theme "everyday life" then they are given the choice of 1) food, 2) drinks, 3) cement, 4) alcohol, 5) cosmetics, and 6) cleaning powder. Students may choose a maximum of 4 from the options given. The technique of filling in > 1 option means that the percentage per theme will not be 100% in total to obtain representative data. Analysis of questionnaire data uses percentage results that have been processed and cumulative through the form created. This format aims to ensure that the interpretation of data of interest is representative, accurate, and scientific. The sample used chemistry education students from the 2020-2023 class (N=139). Research methods and concepts can become the basis for further research so that sustainability occurs and quality education is obtained. The research procedure conducted by adopting Creswell's (2012) research stages can be seen in Fig-1.

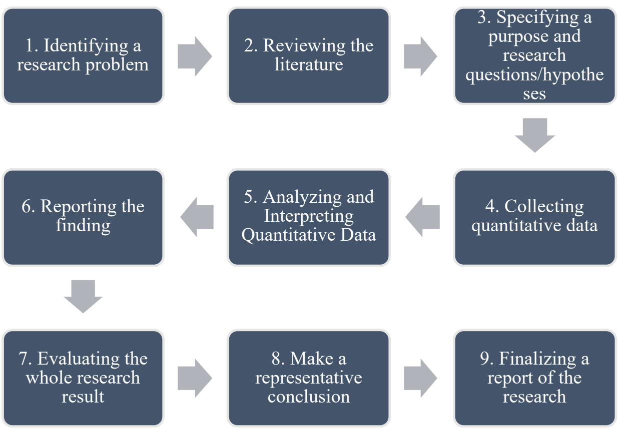

Fig-1. Survey research procedures (Creswell, 2012)

The initial stage of research is profiling students by tracking various students' academic histories (identifying a research problem). Several findings show that students are still considered weak in their thinking abilities, especially at the sub-microscopic level. It is important to know these abilities so that they can be linked to the analysis of the interests obtained. The point most recommended by students is integrating life contexts into the learning process to obtain diverse and broad literacy. Next, review some relevant literature such as books, research-based articles, and others. The basic reference for aspects of interest is the book by Barke et al. (2012) with title "Essentials in Chemical Education". The results found that the "interest" aspect was the most influential part so this aspect became the main target (Reviewing the literature). Even though there are many problems in the context of chemistry education, interest is a point in itself so that students' thinking abilities can be improved. In addition, interest research has the potential to become the basis for developing innovative learning for teachers in the school environment. Based on the results of the review, it was decided to detect a picture of chemistry education students' interests (Specifying a purpose and research questions/hypotheses).

Interest data was collected using a questionnaire technique in the form of presenting various statements taken from the book "Essentials in Chemical Education" by Barke et al. (2012). The statement focuses on the context of chemistry education and all components that are relevant to human life. These items are very helpful in finding participants' interests in the context of chemistry. Apart from the book Barke et al. (2012), interest is also added to several themes that represent current issues such as digital technology, teaching and learning, and diversity. The addition of an "interest" theme is to add reference data related to interests so that teachers can obtain a lot of information to design complete learning, especially in a higher education environment.

The data collected is then analyzed and interpreted to find patterns and meanings related to the issue being studied (Analyzing and Interpreting Quantitative Data). Next is finding interesting things related to the issue (Reporting the findings) and evaluating what was done during the research (Evaluating the whole research result). Complete findings are the basis for determining representative conclusions so that the research results follow the written objectives (Make a representative conclusion). The final stage is to report on the implementation of the research as a whole and it is hoped that the research findings will become reading material and references for teachers, especially students of chemistry education and other science fields (Finalizing a report of the research).

Results and Discussion

Interest detection is an analysis process to find out what things are interesting in a student's environment. This includes various themes from Barke et al. (2012) such as everyday life, nature and environment, chemical processes, and chemical industries. Additional themes such as digital-based technologies, teaching and learning, and diversity. The addition of this theme is considered very relevant and familiar to human life so understanding student interests based on the themes mentioned could be the best solution. Barke et al. (2012) explained that the success of a chemistry lesson can start with knowing the students' interests. Knowing interests can make it easier for teachers to design chemistry lessons. Interest-based learning is the most effective way to train students to understand the material in depth and form scientific mental models (Adbo and Taber, 2009; Barke et al., 2009; Barke et al., 2012; Schwedler and Kaldewey, 2020; Suja et al., 2020; Rusmansyah et al., 2021).

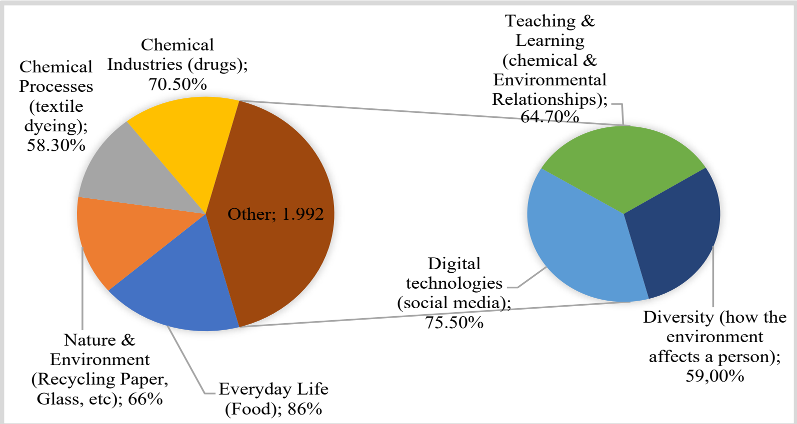

Fig-2. Results of analysis of interest in chemistry education students for all themes (specific presentation of the most dominant topic)

The illustration in Fig-2 is the result of an interest analysis of chemistry education students at FKIP ULM. Statistically (in percentage), the everyday life theme (specifically on the topic of food) has the highest percentage, namely 90%, while chemical processes (on the topic "textile coloring") have the lowest percentage, namely 58.30%. The second largest percentage of 75.50% is "social media" for the digital technologies theme and four other topics below 71% such as recycling paper, glass, etc. for the nature and environment theme, the relationship between chemistry and the environment for the teaching and learning theme, medicines for themes of chemical processes, and diversity (how the environment affects a person). The following discussion shows each theme discussed specifically based on the recapitulated data.

The Fig-3 shows that the food topic received the highest percentage at 86%, while the lowest topics were alcohol and cement with the same percentage, namely 2.20%. The topic of drinks has the second highest percentage, namely 71.30%, meaning that this point is quite popular with students after food. The topics for action on environmental improvement and cosmetics had almost the same percentage, namely 56.80% and 57.60% respectively, while other topics such as fertilizer, cement, fuel, cleaning powder, and bathroom cleaners were the main topics. with a percentage of no more than 13%. Statistical data shows that students prefer to discuss food topics compared to other topics so that food topics can be an initial analysis for developing project ideas and implementing them in the chemistry learning process.

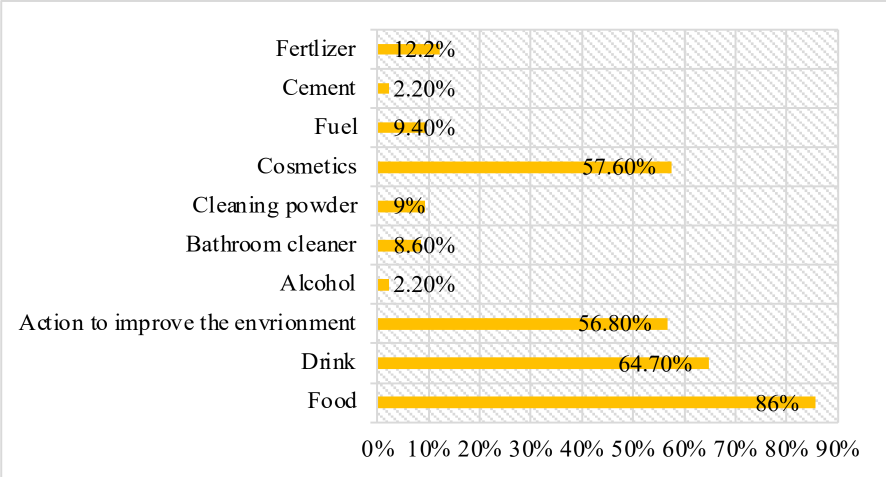

Fig-3. Visualization of statistical data on the theme “everyday life”

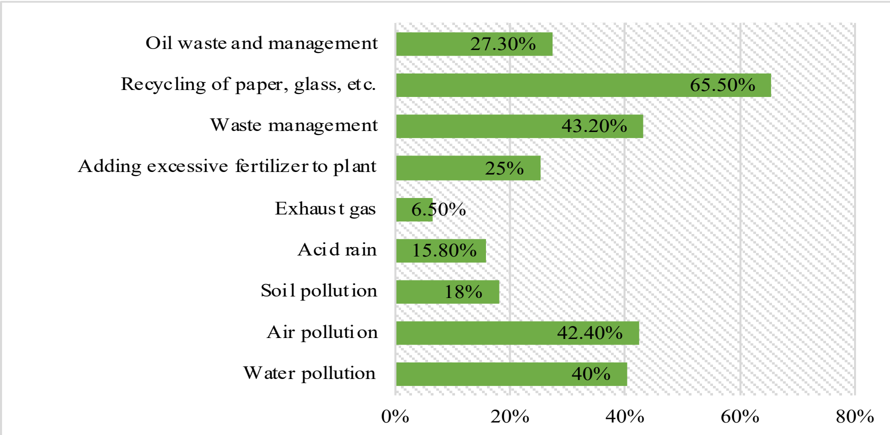

Fig-4. Visualization of statistical data for the theme “nature and environment”

Human activity is the most real visualization of how chemistry is present in human life. Experts even explain that all human actions are related to chemistry so every individual must realize how important it is to have a scientific understanding and care about the environment from a scientific perspective (Gilbert and Treagust, 2009; Barke et al., 2012). For example, humans consume rice (carbohydrates), honey (fructose sugar), fruit (vitamins), and others. In the context of learning, the teacher's ability to integrate human activity into learning is mandatory. This integration is the main basis for students being able to interpret chemistry as a whole so that negative paradigms can be slowly reduced, including in the school environment.

The theme of nature and the environment is a discussion that is also an important part so this theme needs to be analyzed. The topics presented are also very familiar with student activities so that research results can be used as a benchmark in developing chemistry projects/learning. Fig-4 shows that the most popular topic is recycling paper, glass, etc. with a percentage of 65.50%, while waste gas is the topic with the lowest percentage at 6.50%, meaning that the topic of waste gas tends to be of little interest to students. Next, waste management, air pollution, and water pollution are quite popular topics with a percentage of more than 40%, while other topics have a percentage of no more than 28%. The conclusion is that the topic recycling process needs to be involved in developing interest-based projects because this topic has the largest percentage compared to the others. Involving the topic of recycling can be interesting in student presentations, especially when this topic is connected to the context of human activities. The integration carried out is an interesting point so that students understand chemical material in depth and the relevance of this material to human activities, especially those related to the recycling process of paper, glass, etc.

Fig-5 is the theme of chemical processes because this has crucialities that chemistry students need to know. Based on the graph above, the topic of textile coloring has the highest percentage at 58.30%, while the topic of glue has the lowest percentage, namely 10.10%. Apart from that, the detonation or explosive process was the second highest topic with a gain of 48.20%, while others obtained around 30-32%, namely rocket engines, fuel cells, and photo production. Other topics such as batteries, metal alloying processes, and galvanization have percentages below 20%. Data related to chemical processes shows that the topic of textile coloring is the main thing that must be studied and integrated into the development of projects in studying chemistry to train students' thinking abilities.

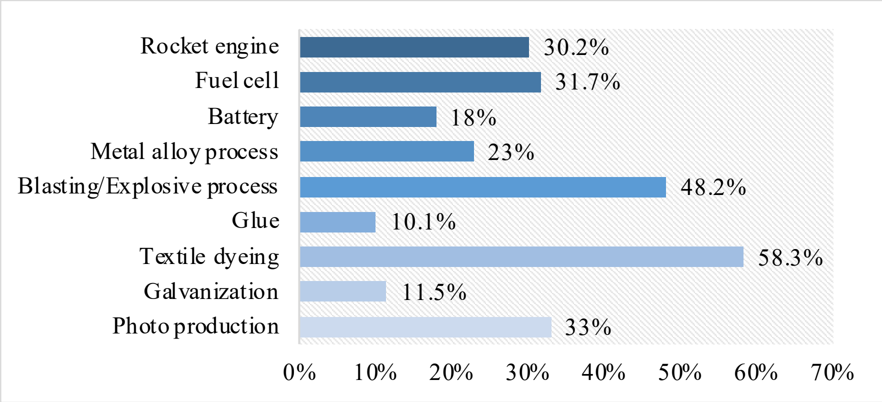

Fig-5. Visualization of statistical data for the theme "chemical processes"

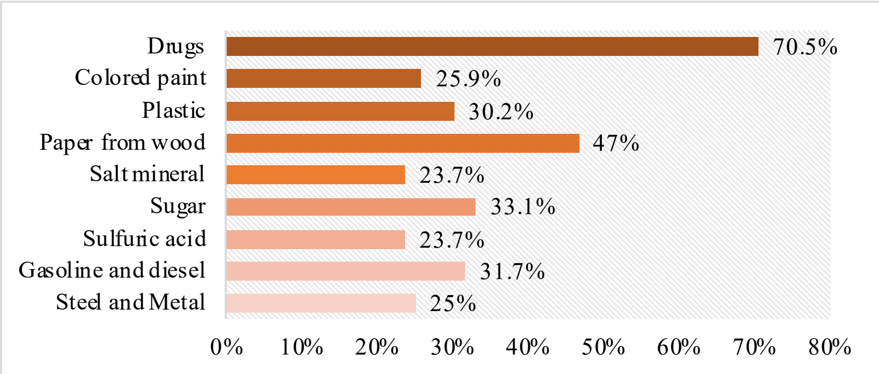

Fig-6. Visualization of statistical data for the theme "chemical industries"

Data regarding the chemical industries theme shows that drugs have the highest percentage, namely 70.50%, while the smallest percentage is the topic of mineral salts and sulfuric acid with the same percentage, namely 23.70%, meaning that medicines are the topic most interested in by students to discuss in class (Fig-6). The topic of wooden paper was the second highest with a score of 47%, so this topic was quite interesting for students to discuss. Others such as plastic, sugar, petrol, and diesel have percentages above 30% but other topics have percentages of around < 26%. In the context of interest, medicine is the main point in working on research projects because this topic is very relevant to human activities. Medicine is also an element that is quite close to student life so this topic is something that students want to discuss in depth.

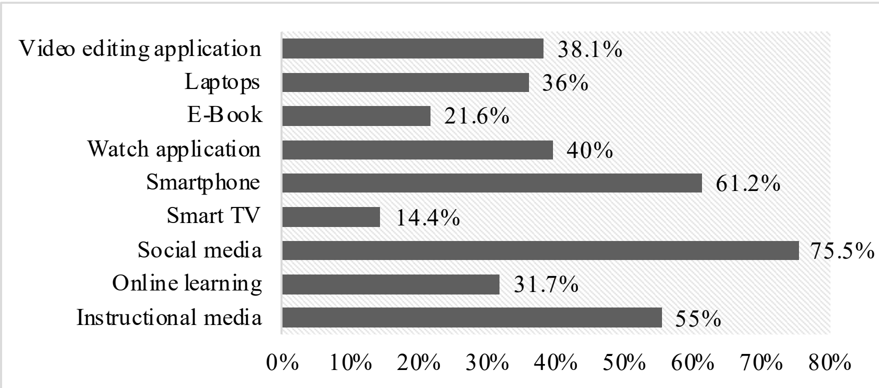

Fig-7. Visualization of statistical data for the theme "digital-based technology"

Digital technology is a topic that is close to people's daily lives, especially the younger generation or Gen Z (Generation Z). Experts say that Gen Z is called digital natives or the active digital generation, meaning that technology is the main need of today's young generation (DeWitte, 2022). The Fig-7 above shows that the topic of social media is the most popular topic among young people with a percentage of 75.50%, while smart TV is the least popular topic with only a percentage of 14.40%. Apart from the topic of smartphones and learning media which received a percentage above 50%, other topics had no more than 40%, such as video editing applications, e-books, watching applications, and online learning. Based on the results of the analysis, the topic of social media is very important to discuss in class considering that this issue is very trendy among teenagers, especially Generation Z. This means that this topic is very interesting to use as an assignment point and as a discussion in the chemistry learning process.

In the context of chemistry education, the topic of teaching and learning is the most crucial thing for students because this topic is an important part for them as prospective teachers. The essence of this topic is to find out the extent of student interest in the field of teaching and learning because it relates to student competence as prospective teachers. From the Fig-8 above, chemistry books are the least interesting topic to discuss with a percentage of under 14%, while the topic of chemical and environmental relations has the largest percentage, namely 65%. The second highest topic is the relationship between chemistry and humans with a percentage of 58.30%, while the others are in the range of 35-48% except the topic of the relationship between chemistry and animals which has a percentage below 30%. Statistical symptoms confirm that students are currently more interested in discussing and hearing topics about the relationship between chemistry and the environment so that this point can be used as a basis for developing projects or learning concepts.

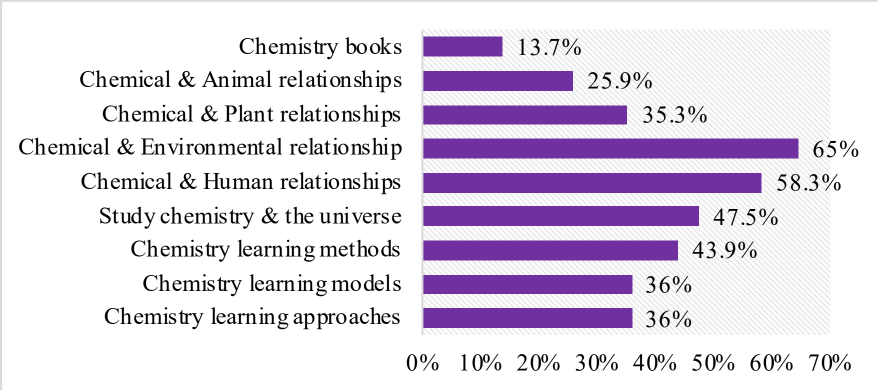

Fig-8. Visualization of statistical data for the theme "teaching and learning"

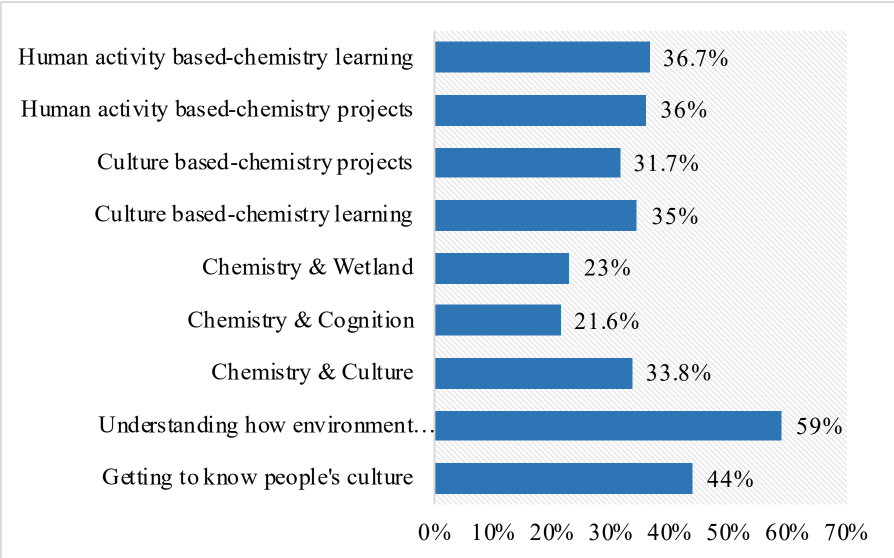

Fig-9. Visualization of statistical data for the theme "diversity"

Diversity is a very interesting topic when it is related to chemistry learning, including the term collaboration in teams. Experts argue that in the context of 21st century skills with the article "More work in diverse teams spanning languages, cultures, geographies, and time zones" (Trilling and Fedel, 2009)" and "The acute need for global cooperation on environmental challenges", meaning that the themes of diversity and collaboration are parts that need attention for the younger generation (Trilling and Fadel, 2009; Taylor and Sobel, 2011). In the learning context, the diversity theme mentioned by (Trilling and Fadel, 2009) has a big impact on teachers, that heterogeneity in one classroom can occur so teachers need to be equipped with skills in that context.

Regarding the topic above (diversity), Fig-9 shows that almost 60% of students are more interested in hearing or discussing the topic of understanding how the environment affects other people, while chemistry and cognitive abilities have the least interest, namely under 22%. Other topics are in the range of 31-37% except for the topic of getting to know other people's cultures (44%) and 23% for the topic of chemistry and wetlands. This means that these topics are quite interesting for students, especially the largest percentage, so these topics need to be part of the discussion in class. In the study of the next generation science standards (NGSS, 2013), diversity is a point that is also of concern to teachers so that participants obtain knowledge equally without distinguishing between one another. Other studies also state that teachers need to be sensitive to differences that occur because these situations influence the teaching designs created (Trilling and Fadel, 2009; Taylor and Sobel, 2011). This means that the theme of diversity can be a recommendation to be integrated into the chemistry learning process so that students have a lot of literacy to develop cognitively.

Some of the limitations found are that students can choose a maximum of 4 from each theme given in the questionnaire so that the percentage results exceed 100% in each graph. Even though the data obtained is very useful, choosing only 1 topic in each theme allows researchers to focus more on studying dominant interests (in percentage terms). The samples used only come from chemistry education study programs so that the data is representative only from the chemistry learning environment. Large amounts of data originating from all areas of science education can represent a complete picture of the interests being studied.

Based on the research results, it can be concluded that interest analysis in the chemistry learning environment is rarely carried out even though the data obtained has a significant influence on how to manage and design chemistry learning. The survey conducted also provides accurate information regarding student interests so that these findings make it very easy for teachers and study program managers to develop curriculum and learning scenarios in the future. The accuracy of the results from conducting the study makes this research worthy of being used as a reference in assessing students from the context of interest.

Conclusion

The study results show that detecting interest components in students can be the main data that helps teachers in designing chemistry lessons. The findings can also be part of students' reflection as future teachers considering the significant changes in the mindset of the younger generation due to digital culture. This research can also be used as an analysis of learning needs because high interest in learning influences students' academic performance, meaning that achieving goals in lectures is greatly influenced by the level of student interest. The methods used can also be adopted by students as preparation for students when they become teachers. Adopting research can be a medium for sustaining ideas so that teachers and prospective teachers use this research as a reference in developing learning that is relevant to today's needs.

Conflict of Interests

The author(s) declares that there is no conflict of interest in this research and manuscript.

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