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Submission date: 17-Aug-2023 12:53AM (UTC-0600)
Submission ID: 2146915708
File name: Neneng_Aksioma_2023_1.docx (89.99K)
Word count: 4273
Character count: 25299

AKSIOMA: Jurnal Program Studi Pendidikan Matematika
Volume 0, No. 0, 20xx, 00-00

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm

ENTREMATH: TEACHING MATERIAL IN IMPROVING THE PROBLEM-SOLVING ABILITY

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Received dd Month yy; Received in revised form dd Month yy; Accepted dd Month yy (9pt)

Abstrak (12pt)

The purpose of this study is to evaluate the validity, applicability, and efficacy of the digital entrepreneurship-based mathematics module in enhancing students' problem-solving abilities. With pupils from vocational school's class XI courses, this study applied the ADDIE paradigm. Data were obtained using Entremath validation questionnaires, student and teacher response questionnaires, and *post-test* scores. The outcomes demonstrated that the math was entrepreneur-based. Entremath was deemed to fall under the criteria of being very valid. Declared practical, with 86.9% of students and 96% of teachers falling into the extremely practical category, and effectively denoted by a sig value greater than t table. The results of entrepreneurial mathematics research contain qualities that can be used to mathematics education.

Kata kunci: : teaching material, entrepreneur character teaching, Mathematical problem solving. (10pt)

I. Introduction (12pt, 10%)

Due to a number of factors, vocational students in Indonesia still struggle to solve mathematical problems. These include the following: (1) they are not accustomed to solving problems that start with writing, knowing, or asking; (2) they have not been able to define and model problems well; and (3) there are still a lot of students who make calculations mistakes; (4) The student does not re-examine the results that have been obtained. A low mathematical problem-solving ability level is also often found in learning composition functions and inverse functions. There are difficulties experienced by grade XI vocational school students in solving the problems of composition function and inverse part caused by factors of inability to compile the given problem-solving steps and lack of skill in operating the composition "," function and inverse function (Susanti & Lestari, 2019).

One of them is because of the teacher's instruction methods, which do not create learning models, so pupils have a low capacity to solve issues involving composition functions and inverse functions. Despite the fact that the 2013 curriculum calls for a shift from teaching to learning and from the teaching community to the learning community (Kamin et al., 2021).

Teachers can integrate mathematics learning with *entrepreneurship* education by innovating learning in methods and media used. With the existence of understanding media, the learning

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Volume 0, No. 0, 20xx, 00-00
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process can surpass the student experience in learning in class. Using media, students can get experiences that cannot be obtained when learning in class. For example, students can see objects they cannot see in the classroom.

One of the learning tools that can be utilized in the study of mathematics is the digital module (Entremath). A digital learning resource called Entremath is accessible (WitaHarahap & Surya, 2017) content organized by the abilities to be attained on a computer or mobile device (Ramadanti et al., 2021).

According to theory and some prior research, learning media can be combined with other fields of knowledge, like entrepreneurship, and with learning models, one of which is mathematics realistic, in order to improve students' ability to solve common mathematical problems.

The generated Entremaths are therefore valid, and the teaching strategies used are realistic and successful in enhancing students' capacity for solving mathematical problems. While the following research questions need to be answered: (1) How valid is entrepreneur-based mathematics like Entremath? (2) How useful is the entrepreneur-based mathematics program Entremath?, (3) How well can entrepreneurship-based mathematics Entremath support students' math learning?

1. Literature Review

Ineffective classroom learning will come from teaching without written preparation since the teacher has not considered what and how the learning process occurs. The capacity of the teacher to create lesson plans depends on their comprehension of evaluation tools and their knowledge of learning theories, models, strategies, and tactics. Teachers' intent to create learning experiences that incorporate affective, psychomotor, and cognitive components can be determined by their ability to select concepts, models, systems, learning strategies, and indicators of learning questions.(de Vries et al., 2015)(Aminah et al., 2020)(Loveless, 2011)(Wahyuni et al., 2021)(Rossi & Trevisan, 2018)(Aminah et al., 2020). We will talk about pertinent research and literature that serve as our primary sources for performing research.

2.1. Relevant research

The research conducted (Yulando et al., 2019) revealed that learning using the Entremath motivates students, and analysis of the development of the Entremath provides interactive features for students to use. Study (Martin et al., 2015) presents an interactive multimedia instructional module developed to guide historical cities. Math equations are created via a methodical process of analysis, design, development, implementation, and evaluation. Multimedia Interactive Interactive Entremath. Programs for multimedia creation are made with Adobe Flash. Those who instruct in computer-based learning will gain from this effort.

An organized process of study, planning, development, implementation, and assessment is used to construct mathematical equations. Interactive Multimedia Mathematics. Adobe Flash is used to create software for multimedia creation. This endeavor will benefit those who instruct in computer-based learning. Posttests taken in practical and control classes revealed that studying using the mathematical realistic model and the entrepreneurship-based mathematics Entremath significantly enhance

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

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mathematical problem-solving abilities of students. As a result, this study is better than past studies.

2.2. Entrepreneurship

Creativity is a characteristic possessed by an individual that marks the ability to create something entirely new or combine existing works into new works carried out through interaction with the environment to face problems and find alternative solutions through methods(Krishnawati et al., 2023). Responsibility measures a person's attitude toward carrying out his duties and obligations (Dal , Elo, Leffler, Svedberg, & Westerberg, 2016; Samuel, 2013)

Tolerance for ambiguity is referred to as individual emotional resilience, how individuals can handle and manage stress experienced as a result of ambiguity. Someone who (Sundari, 2015) is entrepreneurial is often faced with uncertain situations (Palmer, Johnson, & Karlsson, 2018; Sundari, 2015). However, what seems to be agreed in this context is that entrepreneurship is something positive and should be taught about entrepreneurship, not entrepreneurship. The context of entrepreneurship here is trained very well in any field; the emphasis is on an entrepreneur's character and way of thinking, not only on his profitability. Regarding mathematical learning, entrepreneurial teaching implies practical and theoretical education on how to start training with a phenomenon that means learning in which students participate in activities in a setting in which they can influence and manage the learning process on a social level. (From J, 2005) (Sarasvathy & Venkataraman, 2011)

The independent campus curriculum built by the Indonesian government has begun to integrate entrepreneurs in cross-study programs. Because entrepreneurial competence is almost identical to mathematics competence in terms of (1) creativity, (2) responsible ability, (3) courage, (4) ability to take the initiative, (5) tolerance for ambiguity, and (6) ability to collaborate, the mathematics study program is very suitable for implementation. (Hanna Palmér, 2018)

Taken together, the character entrepreneurship is learning characterized by problem-solving learning; This is the same as in mathematics learning.

2.3. Digital module

Learning using modules, students can learn individually actively without maximum assistance from the teacher so that students can learn independently. Additionally, by employing modules, students can learn at their own pace and determine their level of achievement when class courses are complete.

The availability of modules provides students with the chance to improve upon or repair weaknesses, oversights, or deficiencies of students, and students can independently discover the assessments provided to continue. Today, the majority of modules are completed on paper. The lack of excitement and interest among students for using print modules is a result of print modules' general lack of variety. (Herawati & Muhtadi, 2018; Sukestiyarno et al., 2021)

Create modules in electronic form that can be used as interactive media since other media, such as images, animation, audio, and video, can be

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incorporated. This is one technique to make modules more appealing to students. Technology utilization is advantageous for education (Papadakis et al., 2021; Poultsakis et al., 2021)

Additionally, due to the modern world's rapid technological advancement, virtually all pupils, with the exception of high school students, are familiar with computers or other electronic media (Sprock et al., 2014). The electronic module's research shows that it is a cutting-edge medium that can boost students' enthusiasm in learning.

The proper learning guide must be used to help a learning process in order to increase learning outcomes attainment. This is due to the fact that the amount of material that needs to be covered requires very little face-to-face time in front of the class. A learning aid that can engage students in learning is therefore required. Learning resources that enhance student learning outcomes and place a priority on students' functional independence include electronic modules. The actual electronic modules (Entremaths) are very similar to e-books. (Feriatna, T, Aminah, 2017)

Only the two documents' content differs. An e-book is defined by Encyclopedia Britannica's Ultimate Reference Suite as an E-file with text and images that is appropriate for electronic dissemination and is shown on a monitor screen similarly to a printed book. A module in electronic form called an entremath, or electronic module, consists of text, graphics, or both that contain electronic content and simulations that may and should be utilized to teach. (Wen & Hua, 2020)

2. Methodology

The method used in this study is a development with the ADDIE model, with a combined qualitative and quantitative approach. This method was chosen because the research objectives called for it, but the preliminary study's Entremath was developed using a qualitative method.

In comparison, the quantitative approach tests the validity, practicality, and effectiveness of this developed Entremath and its learning. This research design uses *Posttest-Only Control Group Design*. Two randomly selected groups (R) were chosen in this study design. In this design, there are two groups; the first group is given treatment (X1) in the form of mathematics learning with a mathematics realistic model assisted by entrepreneurship-based mathematics Entremath(Sukestiyarno, 2020).

While the others are just ordinary learning carried out by teachers in the form of lectures (X2). While the treated group (X2) is referred to as the control class, the treatment group (X1) is known as the experimental class.

Participants

This study involved 16 classrooms of grade XI students at the vocational school. based on sampling using a simple random sample since participants were chosen at random, disregarding the population's stratification. Class XI and class TKJ. Class XI TKJ Two served as the control class, and class One served as

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the experimental class. The experimental class was given therapy in the form of entrepreneurship-based math instruction. Although Entremaths used realistic mathematical simulations, the control class was the only one to get education through lectures, which are the norm for professors. Research class data are presented in Table 1.

Table 1. Class data as a subject

Class	Group	Sum of Students
XI TKJ 1	Experiment	36
XI TKJ 2	Control	36
Total		72

Data Collection

The data in this study is in the form of data obtained from interview sheets, questionnaires, and tests. Interview sheets are used during preliminary studies to discover the fundamental problems at the research site. Then the questionnaire used is in the form of a questionnaire to study student needs during preliminary studies to find out the requirements and character of students in learning mathematics.

In addition, the validity of entrepreneurship-based mathematics Entremaths was assessed using questionnaires from students and teachers as well as students and teachers. In addition, the posttest used to gauge pupils' proficiency in solving mathematical problems.

3. Findings

The research process follows the ADDIE model *(analysis, design, development, implementation, and evaluation)*. This stage is carried out to analyze problems in the field and the need for Entremath development. Some of what is done in this stage are gap analysis, student needs analysis, material analysis, and learning objectives analysis. Furthermore, the design stage includes the product design process (Entremath), learning tools, and compiling research instruments. The Entremath developed in this stage is called Draft 1. Then this *development* stage is the Entremath validation stage which has been prepared as Draft 1. Experts do validation.

In order to validate whether the Entremath developed is valid, validators are given questionnaires or validation sheets. Two professors and one mathematics teacher serve as the validators for the entremath validation process.. Furthermore, the validated Entremaths are then improved into draft 2 based on validator suggestions. Moreover, the implementation stage, at this implementation stage, mathematics learning was carried out using entrepreneurship-based mathematics Entremaths, in practical classes with as many as 4 meetings.

Then, utilizing questionnaires with student and teacher responses, a practicality test was conducted. The last stage is *evaluation*, which is a process carried out to determine the product's effectiveness. At this evaluation stage, posttest tests were carried out in the experimental class and control class. Then after that, the posttest test result data is analyzed.

4.1 Analysis stage

The study' findings take the shape of a needs analysis by looking at the pandemic's conditions for learning needs, reviewing the suitable

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curriculum, specifically the autonomous learning curriculum, and examining the traits of potential teachers. Our analysis' findings are used as a guide when creating a pandemic teaching practice model.

Student Needs Analysis

Based on the results of the questionnaire used to analyze students' needs, it was determined that students need Entremaths as a method of learning mathematics because the teacher only provides material in the form of material sheets and student mathematics books from the Ministry of Education and Culture. In addition, the choice of Entremath is also due to the learning style of students who are primarily linguistic or easier to understand when reading and speaking. So this Entremath is perfect for these students. The learning method used by teachers is in the form of discussion and more often is a lecture or more explaining to students, besides that mathematics learning, carried out has not been associated with the field of entrepreneurship, so a learning strategy that is more focused on students is needed and is related to the world of entrepreneurship. In the learning process, students are accustomed to using technology such as *mobile phones* to support learning. Therefore media in the form of electronic modules or Entremaths is suitable for use by vocational school students.

Gap Analysis

Based on an interview conducted with one of the mathematics teachers vocational school in Indonesia, Students still have a limited capacity for probling-solving mathematical. According to one of the mathematics teachers at the school, many students still cannot solve the math problems given if the problem has a different pattern than solving it with the previous issue. In addition, mathematics learning in class often uses discussion and lecture methods. The material presented by the teacher is only in the form of material sheets containing material points and questions, not material that can facilitate students' mathematical problem-solving skills or that is integrated with problems in the field of *entrepreneurship*.

Material Analysis

Based on the results of the literature study, mathematical materials that are suitable for integration with the field of entrepreneurship in the Entremath to be developed are composition function material and inverse functions.

4.2 Design Phase

The design stage is the second phase of this process. The creation and planning of entrepreneurship-based mathematics occurs at the design stage. Composition function material and equations with inverse functions.

4.3. Development Phase

The entrepreneurship-based mathematics Entremath developed by the researchers is validated by validators, who are two mathematicians from Malaysia and Indonesia and two mathematicians from Malaysia and Indonesia, using validation test questionnaires.

A validation process is used to evaluate the viability of the content, the viability of the language, and the viability of the media. Table 2 displays the outcomes of the validation test performed by three validators on the

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entrepreneurship-based mathematics program Entremath.

Table 2. Results Entremath Validation Test

Aspects	Score Validator			
	1	2	3	Category
Relevant to mathematical material	4	3,75	3,75	1.00-1.50: Invalid
The application used is easily accessible	3,50	4	3,25	1.51-2.50: quite valid
Exploring the Problem solving	3,75	3,75	3,75	2.51-3.50: Valid
Based on entrepreneurship	3.50	3,50	3,75	3,51-4,00: very valid
As a study aid	3,75	3,50	3,75	
Can be used at junior high and senior high school level	3,5	3,75	3,5	
Total	22	22,25	21,75	
Category	3.67 / Very valid			

According to the findings of the validation test by three validators shown in Table 2 of the results, the entremath is valid with an average score % of the three validators of 3,67 and is included in the extremely valid category.

4.4.Implementation Phase

The entrepreneurship-based mathematics Entremath as Draft 2 is then implemented in the class that has been selected as an experimental class, namely class XI TKJ 1. In its execution, the researcher takes on the role of a teacher under the supervision of one of the school's mathematics teachers. Following the completion of learning activities, student and instructor response questionnaires were used to measure the practicality test. The findings of the learning practicality test with help from the mathematics realistic model and entrepreneurship-based mathematics Entremath are explained in the paragraphs that follow.

Based on questionnaires of student and teacher responses to learning using Entremath- mathematics realistic model, the results of the learning practicality test with entremath assisted mathematics realistic model were measured. After learning was finished in 4 meetings, questionnaires with student and teacher responses were distributed. Table 3 below lists the findings from surveys given to students and teachers.

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Table 3. Results of Student and Teacher Response Questionnaire

Not.	Student and Teacher Response Questionnaire	R (%)	Criterion
1.	Questionnaire of student responses to learning using the mathematics realistic model assisted by entrepreneurship-based mathematics Entremath	86,9%	Very Practical
2.	Questionnaire of teacher responses to learning using the mathematics realistic model assisted by entrepreneurship-based mathematics Entremath	96%	Very Practical

4.5.Evaluation Phase

Using posttest mathematical problem-solving abilities, this stage of learning is evaluated. Both experimental and control classes receive posttests. Following analysis, 34 out of 36 students in the experimental class were found to have completed their individual learning with a grade of KKM 70.

The experimental class also completed 75% of its classical education with grades. This indicates that at least 75% of the students in the experimental class received grades. t_hitung=12,7> t_tabel=1,68z_hitung=2,69>t_tabel=1,7 370 pupils who had not completed their individual learning with KKM 70 at the time of the posttest included as many as 22 out of the control class's 36 pupils. Posttest scores did not reach individual completeness and classical completeness with $t_{hitung} = -3{,}32 < t_{tabel} = 1{,}68 z_{hitung} = -5{,}138 < t_{tabel} = 1{,}73$.

Posttest results for the experimental class and control class were also made available. The posttest results for the experimental class and the control class are compared using an independent sample t test.

The results of the comparison test between the experimental class's posttest scores and those of the control class, who did not use entrepreneurship-based mathematics, showed that the experimental class's students' aptitude for solving mathematical problems was superior to that of the control class's students. Mathematical entrepreneurship and education using a realistic model that emphasizes value creation. $t_{hitung} = 10{,}7 > t_{tabel} = 1{,}68$.

5. Discussion

The analysis stage is the initial step in this development research method. The main issue with vocational schools at this point in the analysis is that students' ability to solve mathematical problems is still lacking. Despite the fact that the curriculum calls for a learning process where students serve as the learning center, mathematics instruction nevertheless frequently employs the lecture technique.

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Additionally, the knowledge acquired has not been connected to entrepreneurship,(Sukestiyarno et al., 2021) Despite the fact that there is a great chance that this entrepreneurship will be connected to math instruction in vocational schools (Irani et al., 2022; Nurjaya et al., 2020; Ramadhan et al., 2021). Additionally, there aren't any books or other instructional aids employed in the study of mathematics. Only mathematics student books from a teacher-compiled library of material sheets, which only include material points, are utilized as the learning medium. According to the findings of earlier research, this is seen as less helping pupils' learning of mathematics. (Aminah et al., 2022a, 2022b, 2023; Kilpatrick, 2002; Shodiqin et al., 2020).

The process's second phase is design, and during design, entrepreneurship-based math is used. Entremaths are created and prepared as Draft 1 and include content for inverse and compositional functions. The development step of the program Entremath, which is now in Draft 1, is then carried out, with validation performed by three individuals: two math lecturers and one math instructor.

It can be said that this entrepreneurship-based mathematics Entremath is valid to meet the criteria for eligibility for content presentation, media feasibility, and language feasibility because the validation results show that it is declared valid or feasible with an average percentage of 92.88% and is included in the "Very Feasible" category. These results are in line with the research (Saimima et al., 2022; School & Aryanto, 2016).

Due to the fact that the questions presented in this Entremath must be solved through group discussion, it promotes the realistic learning process for mathematics. The problems in the Entremath are solvable in a variety of ways, making them appropriate for use in applications where the mathematics is realistic. When students read this entrepreneurship-based mathematics Entremath, they are motivated and entrepreneurial characters start to appear in their minds. The material composition function and inverse function are presented with an entrepreneurship narrative that elevates successful entrepreneurs.

The mathematics based on entrepreneurship Entremath is offered as a soft file in pdf format and offers information on composition functions and inverse functions. It is subsequently transmitted via a link to students. This was selected since it is simpler for students to access on computers or mobile devices.

After all, it saves storage space because there is no need to download a program in order to utilize it. Then, this reliable entrepreneurship-based mathematics program Entremath is used. A teacher of mathematics and 36 pupils from the experimental class each received a questionnaire to complete as part of the practicality test.

Based on the findings of the questionnaire analysis of the replies from students and teachers to mathematics learning using an entrepreneurship-based mathematical realistic model, it was found that students, with an average percentage of 86.9%, and instructors, with an average percentage of 96%, were both in favor of the approach, both rated the experience as "Very Practical".

This implies that studying mathematics will be aided by entrepreneurship-based mathematics and the mathematical realistic model. Students and teachers respond well to Entremath because, according to

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Nasution, learning is considered to be practical if it is received favorably by both parties when used in the real world. (Yulando et al., 2019)

A posttest of mathematical problem-solving skills is used to evaluate learning after the subsequent practical test enters the evaluation phase. Both the practical classes and the control classes receive posttests. After analysis, 34 out of 36 students in the practical class met their individual learning requirements with a KKM score of 70, achieving individual completeness with grades. The experimental class also completed 75% of its classical education with grades. This indicates that at least 75% of students in the practical course have earned degrees. t_hitung=12,7>t_tabel=1,68zhitung=2,69> t_tabel=1,7370 posttest scores did not achieve individual completeness and classical completeness with and with students who had not achieved individual learning completeness with KKM 70 were as many as 22 students out of 36 students in the control class.

To compare the posttest values of the control class and experimental class, an independent sample t test was conducted with the following parameters: t_hitung=-3,32; t_tabel=1,68; and z_hitung=-5,138.

The results of the posttest comparison test between the experimental class and the control class revealed that the experimental class students' aptitude for solving mathematical puzzles was superior to that of the control class students, who did not use Entremath and learning with the mathematics realistic model with value acquisition.T_tabel=1,68;t_hitung=10,7.

The benefit of this study is that learning with the mathematical realistic model is merged with entrepreneurship-based mathematics Entremath on the composition function material and inverse function. Entrepreneurship is closely related to problem-solving skills, and according to Mary Olukemi & Ezekiel Gbenga, one of the skills that can support entrepreneurship is solving mathematical problems (Yitshaki & Kropp, 2016).

By combining entrepreneurship-based mathematics Entremath and mathematics realistic learning model, it becomes an exciting combination to improve students' mathematical problem-solving skills. Additionally, research from Supriatna indicates that one of the learning models, the realistic learning model for mathematics, is connected with entrepreneurship. (Amalia & Sukestiyarno, 2021)

can improve students' capacity to solve mathematical puzzles. With the benefits of entrepreneurship-based mathematics Entremath previously discussed, it is also effective at motivating students to develop their entrepreneurial spirit through the use of fundamental skills found in this entrepreneurship-based mathematics Entremath. This is in addition to effectively improving students' mathematical problem-solving skills.

6. Conclusion

According to the findings of the development research that was carried out, it can be said that (1) entrepreneurship-based mathematics Entremath was declared valid with validation results by 3 validators with an average percentage of 92.88% and was included in the "Very valid" category, and (2) mathematics learning with the assistance of entrepreneurship-based mathematics Entremath is declared practical with an average percentage of practical score.

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The customary comprehensiveness of the grades obtained and additionally, depending on the post-test comparison test results between the experimental class and the controlclasst_hitung=12,7>t_tabel=1,68 z_hitung=2,69> z_tabel=1,73t_hitung=-3,32 t_tabel=1,68z_hitung=-5,138 z_tabel= 1,73, it was discovered that the experimental class students' aptitude for solving mathematical puzzles was superior to that of the control class students', as determined by grades.t_hitung=10,7> t_tabel=1,68.

7. Acknowledgments

The author thanks Swadaya Gunung Jati University, Indonesia for grand research collaboration with Universiti Kebangsaan Malaysia, and SMK in Cirebon, Indonesia.

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Article Error You may need to use an article before this word. Consider using the article **the**.

Possessive You may need to use an apostrophe to show possession.

S/V This subject and verb may not agree. Proofread the sentence to make sure the subject agrees with the verb.

Article Error You may need to use an article before this word.

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Confused You have used **from** in this sentence. You may need to use **form** instead.

Proofread This part of the sentence contains a grammatical error or misspelled word that makes your meaning unclear.

Frag. This sentence may be a fragment or may have incorrect punctuation. Proofread the sentence to be sure that it has correct punctuation and that it has an independent clause with a complete subject and predicate.

Word Error Did you type "**the**" instead of "**they**," or have you left out a word?

Proofread This part of the sentence contains a grammatical error or misspelled word that makes your meaning unclear.

Sentence Cap. Remember to capitalize the first word of each sentence.

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Run-on This sentence may be a run-on sentence. Proofread it to see if it contains too many independent clauses or contains independent clauses that have been combined without conjunctions or punctuation. Look at the "Writer's Handbook" for advice about correcting run-on sentences.

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