Designing online class learning of sine rule using ramadhan tradition context

F Aisyah, F Nursyahidah* and W Kusumaningsih
Mathematics Education Department, Universitas PGRI Semarang, Indonesia

*Corresponding author’s e-mail: faridanursyahidah@upgris.ac.id

Abstract. This research aims to create a learning trajectory by using Ramadhan tradition in Pemalang as a context to assisting students in recognizing the concept of sine rule. The approach used in this research was Realistic Mathematics Education. The subject of the study is the tenth-grade students of SMA N 1 Belik, Pemalang, Jawa Tengah, with six student participants who have been chosen as heterogeneous students. The methodology used is design research consisting of three stages, namely preliminary design, design experiment, and retrospective analysis. Nonetheless, this analysis only shows the results of the design experiment stages, in particular, the pilot experiment. Data collection was carried out using a variety of methods, namely: video recordings, photos, student work results, and student interviews during online learning. Student learning activities comprise three activities: observing night market video to find facts about the triangle, observing Takbir keliling video to find the concept of the sine rule, and solving a contextual problem related to the sine rule. The results of this study show that a series of activities designed could help students understand the concept of sine rule by using skype as a media and Ramadhan tradition in Pemalang as a context.

1. Introduction
Mathematics has an important part in any level of education. The topic of mathematics in schools taking a crucial role in preparing students to think critically, creatively [1][2], logical, analytical, systematic [3], communicating, problem posing, problem-solving, and collaborating [4]. This idea shows the significance of considering the mathematics. One of the essential topics of mathematics to be considered is trigonometry [5][6][7][8].

Trigonometry is an important material for students to concentrate in high school curricula which comprise content areas including angles, measurement angles, triangles, and their connection [7][9][10]. Furthermore, trigonometry is additionally a huge material for students to learn because it is closely related to daily life and also among the essential materials that connect algebra, geometry, and graphics [5][7]. This opinion is in line with Fui, Shahril, and Mundia [11] which states that through trigonometric understanding and application, students will consider it easy to associate thoughts in and among connecting mathematics and other disciplines. This implies the importance of trigonometry for students [12]. However, trigonometry is still seen as difficult and abstract material for students compared to other topics in mathematics [13][14][15][16].

The lack of students' abilities in trigonometry material, particularly in sine rules material triggered through some aspects. Study shows that many students have an inconsistent interpretation of the three primary ways of interpreting the sine: as the point coordinates of the unit circle, as the horizontal and
vertical distances that are the graphical intersections of those coordinates, and as the side ratios of the reference triangle [17][18]. In addition, the students’ difficulties were have not been capable to enhance the idea of sine rule so that students have concerns solving troubles related to the material [18]. Students have a concern about learning the sine rule because students are much less able to link between present concepts in mathematics [19]. Difficulties experienced by students are also because learning the sine rule is insignificant [20]. Students only memorize formulation hindering understanding the basic concepts which are the most essential part of studying further complex material [21][22][23].

Several aspects make students arduous in learning sine rule, among them, are teacher aspect, student aspect, and learning resource aspect [12]. From the teacher aspect, students’ difficulties are because there are quite many teachers who use teacher centre nor query and answer method [24]. It implies the learning process is as yet concentrated on the teacher and students have not played an active role in learning since it’s just restricted to queries and answers [25]. Concerning the students’ aspect, it causes a lack of students’ motivation in learning sine rule because students no longer apprehend the relationship of trigonometry with daily life [21] and lack the cognitive skill of students [12]. While from the aspect of learning resources, a bunch of mathematics books furnished in bookstores provide developed steps without offering any space for the students to be occupied in the manner of discovering the formulas [12].

Consequently, we need a better path for students to construct their lessons given by teachers and teachers need to do the design of learning materials that will use in class to make learning compelling [26][27]. However, nowadays there are as yet numerous teachers who have not yet designed the learning material to be applied in class, explicitly in online class learning such as in the COVID-19 pandemic period as it is today. In such a manner, the teacher must design the learning process with the appropriate approach and context alongside the use of media to assist online learning.

One of the endeavour that should be achieved to improve the quality of mathematics learning, mainly the material sine rule in high school, is encouraging mathematics utilizing the Indonesian Realistic Mathematics Education (PMRI) approach [28]. PMRI refers to the notion of Freudenthal in Realistic Mathematics Education (RME). There are two perspectives from Freudenthal which are (1) mathematics must be associated with the real world; and (2) mathematics as human activity [29]. First, mathematics must be close to students and related to students’ daily life. Second, it is emphasized that mathematics is a human activity so students ought to be allowed the chance to engaged learning activities on every topic in mathematics [30]. The precept of a realistic mathematical approach starts often evolved with the visualization of concrete objects or the use of context around students first to the most abstract level [31].

PMRI has been extensively applied in mathematics learning to facilitate students to grasp mathematical concepts [32] and can enhance students’ capabilities and motivation in solving mathematical calculation problems [33][34][35][36][37][38][39][40][41]. The context used in this study is the tradition of Ramadhan in Pemalang, which contains two major traditions, namely the night market and the Takbir Keliling. The tradition of the night market is used as it can represent content for the quest of triangular facts. In addition, Takbir Keliling tradition which is one of the traditions of Indonesian Muslims in welcoming Eid Al-Fitr 1 Shawwal. Authors choose the tradition of Takbir Keliling because in this tradition can represent the material rules of sine rule. Moreover, the determination of a context tradition of Ramadhan allows students to interpret mathematics, open up the exactness of mathematics and local wisdom, and make students more motivated and cooperate on material utilizing sine rule.

In addition, the proper media to be utilized in online class learning is skype which is a communication platform that permits students and teachers up close and personal straightforwardly through discussion and has features that support the learning manner such as screen sharing, video conference, and call recording. This is following the opinion of Dickson, Jones, and Lund [42] that utilizes Skype in the learning process. This statement is also supported by Ockert [43] and Yeo [44] who state that Skype is one platform that provides distance learning, increases student motivation in gaining knowledge of and is convenient to use by students (user-friendly). Skype in mathematics learning that can improve students’ collaborative grasp through discussion [45]. Therefore, this research utilizes Skype as a
learning medium in the material sine rule, because it facilitates teachers in performing online class learning during the Covid-19 pandemic.

To enforce the research, the authors used the design research method. It involves three stages, namely: preliminary design, teaching experiment (pilot experiment and teaching experiment), and retrospective analysis. Nevertheless, this research focus was confined to the pilot stage of the experiment. Based on the background above, the authors' research intending to develop a hypothetical learning trajectory to support students to find concept sine rule using skype and Ramadhan tradition as a context.

2. Methods
The methodology used in this research is design research that comprised of three stages, specifically preliminary design, teaching experiment (pilot experiment and teaching experiment), and retrospective analyzed [46]. This research is restricted to a pilot experiment stage which was performed on May-June 2020. The subject of this study was 6 students of tenth-grade students of SMA N 1 Belik, Pemalang, Jawa Tengah. This research was led in the second semester of the academic year 2019/2020. Design research is a method aiming to develop the Hypothetical Learning Trajectory (HLT) to improve the quality learning process. In this study, the developed design was Hypothetical Learning Trajectory (HLT) which contained a series of students’ learning activities. The manner in this research design is a cyclic process (repetitive). The cyclic method is a method from notion experiments than to learning experiments in the form of diagrams and illustrations of experimental ideas [46].

3. Results and discussion
The online learning process comprises several activities. Before and after the lessons, students are given pre-tests and post-tests to assess students' analytical skills. Below is figure 1 shows throughout the online class of sine rule using skype.

![Figure 1. Illustration during the online class of sine rule using skype.](image)

The activities carried out as follows:

3.1. Activity 1: Observing video of Night Market to find triangle facts
Activity 1 is an apperception part of the material sine rule. The teacher gives apperception in the form of online quiz games and students’ worksheets. The teacher gives apperception with an online quiz game through quizziz (www.quizziz.com) which is fascinating to extend students’ motivation in beginning mathematics learning and additionally reminds material that has been taught earlier than pertaining to sine rule. Students are quite enthusiastic about working on quizzes, this can be seen from students who work on quizzes not simply once. The teacher discusses the quiz appraisal after students have finished the quiz through quizziz. The overview of the results of the online student quiz games can be seen in figure 2.
Figure 2. The students result in an online game quiz.

Furthermore, activity 1 additionally incorporates activities to find facts of the triangle through the night market video. This is the phase of the apperception of the use of students' worksheets. First student observing night market video using skype video conference. Afterward, the teacher corporations students into groups through the skype discussion group chat feature that permits students in groups to make video calls and different facets in skype to facilitate students in discussion. The teacher offers students' worksheets questions in pdf form with fascinating designs.

Then the teacher asks students to work together in groups to clear up problems in students' worksheets. In this stage, the teacher is solely as a facilitator to observe the activities of students in the skype group. The teacher asks students to send each completed answer to the discussion group chat to make it easier for the teacher to observe student discussions in finding triangle facts. After the discussion, one of the groups presented their results thru skype video conference. From the solutions presented, students' perception of triangle facts started to build. Students can deduce what are the elements of a triangle and provide an explanation for the altitude in a triangle. The outcomes of students' work in a group can be considered in figure 3.

Figure 3. Students answer on the first activity.

Based on figure 3, students are requested to perceive what are the elements of a triangle and explain what the altitude in a triangle is. Furthermore, to locate out more clearly an interview with students used to be conducted. The outcomes of interviews with students can be concluded that students can become aware of the elements of a triangle and give an explanation for what altitude is genuinely and well. From the written outcomes and interviews, it was proven that the purpose of this endeavour used to be achieved.

3.2. Activity 2: Observing video of Takbir Keliling tradition to find sine rule concept
In activity 2, involves presenting the Takbir Keliling as a context for discovering the concept of sine rule. By using the context of the Takbir Keliling, students are expected to discover an illustration of a
triangle from the *Takbir Keliling* route. At the beginning of the lesson, the teacher gave an apperception by asking, "Is there anyone of you who has followed the *Takbir Keliling* tradition?", "How was your experience when followed that tradition?" This activity makes students answer the problem with excessive enthusiasm. Students are additionally requested to draw an illustration of a triangular *Takbir Keliling* route in the shape of a triangle and give names to every vertex. After that students are asked to draw all the altitudes and determine all the sine angles formed in the triangle by paying attention to the altitude that has been predetermined. From these questions, students will locate the concept of sine rules. Then, the answer’s students can be considered in figure 4.

![Figure 4](image4.png)

**Figure 4.** Students answer to find the sine rule concept.

Based on figure 4 indicates that students can solve problems with group chat discussions in skype. Besides that, from the result of the interview, it can be covered that students can find the notion of sine rule by means of their self with constructive questions on the student worksheet. From the written result and interview it used to be verified that the cause of this activity 2 was achieved.

### 3.3. Activity 3: Solving contextual problems related to sine rule

In this activity, students were asked to resolve contextual problems related to the sine rule. Students had been able to unravel the problem with the notion learned in previous material. In addition, the results of the students' answers are shown in figure 5.

![Figure 5](image5.png)

**Figure 5.** Students answer from the given problem.

Based on figure 5, students are already acquainted with the problem of sine rule so it is evident that students have grasped the idea of sine rule to be able to resolve the problem correctly. The outcomes are consistent with the goals for a hypothetical learning trajectory.

The PMRI approach is quite well utilized in mathematics online learning due to the fact with the aid of using this approach students are requested to discover their thoughts of sine rule material with the assist of contextual problems surrounding the students. It is in line with numerous research [32][33][34][35][36][39][40] asserted that using PMRI approaches in learning processes through the
use of outstanding contexts can help students recognize the concept learned. With the assist of the context of Ramadhan tradition, a Muslim tradition in Indonesia that is held every year where students are familiar with and also packaged in an interactive video and skype as proper media that has many aspects to assist students to do online classes so students are enthusiastic and more active in the learning process that is why they can apprehend the idea deeply. It is additionally in line with the outcomes of the questionnaire given by students after online class learning. Students feel more active and can discuss properly during the learning of sine rule using skype.

4. Conclusion
The hypothetical learning trajectory resulted in this study composed of four activities, that is: observing the video of the night market to find facts of the triangle, observing the video of Takbir keliling to find the concept of sine rule, and solving problem-related to sine rule. The result of this research specifies that a series of activities that have been designed could support to excite the students comprehending of the concept of sine rule using skype as media and Ramadan tradition as context.

References
[1] Kwan Y, Wand Wong F L 2014 Learning Environ. Res. 17 191–207
[2] Tandiseru S R 2015 J. Educ. Pract. 6 74–81
[3] Linse R 2016 J. Educ. Pract. 7 2006-12
[4] Gravemeijer K, Steoham M, Julie C, Lin F L and Ohtani M 2017 Int. J. Sci. Math. Educ. 15 105–23
[5] Weber K 2005 Math. Educ. Res. J. 17 91-112
[6] Demir Ö 2012 Students’ Concept Development and Understanding of Sine and Cosine Functions (Thesis) (Netherlands: Universiteit van Amsterdam Korteweg-de Vries Institute for Mathematics)
[7] Tuna A 2013 J. Educ. 3 1-9
[8] Gurat M and Sagun M J 2018 Int. J. Res. Stud. Educ. 7 91-102
[9] Rizkianto I, Zulkardi and Darmawijaya 2013 J. Math. Educ. 4 160-71
[10] Ahamad S N, Li H C, Shahrill M & Prahmana R C I 2018 J. Phys.: Conf. Ser. 943 012008
[11] Fui L F, Shahrill M and Mundia L 2015 Res. J. App. Sci. Eng. Technol. 9 952-962
[12] Ishartonio N, Juniati D and Lukito A 2016 J. Res. Adv. Math. Educ. 1 154-171
[13] Cetin O F 2015 Educ. Res. Rev. 10 338-50
[14] Kamber D and Takaci D 2017 Int. J. Math. Educ. Sci. Technol. 52 11–15
[15] Maknun C L, Ikhwonudin T and Rosjanuardi R 2018 Proc. INTCESS- 5th Int. Conf. Educ. Soc. Sci. (Istanbul: INTCESS)
[16] Fernández E M, Hidalgo J F R and Rico L J. Math. Sci. Technol. Educ. 15 1-18
[17] Brown A S 2006 Proc. 30th Conf. Int. Group Psychol. Math. Educ. (Prague: PME30)
[18] Orhun N 2013 Educ. Res. Rev. 8 1158-65
[19] Klein M E 2015 CERME 9 - Ninth Congress of the European Society for Research in Math. Educ. (New York: Routledge)
[20] Arbowo B W, Lestari A A P, Aisyah F and Nursyahidah F 2018 Developing Student’s Activity with Wisanggeni Puppet Context to Enhance Students’ Understanding of Addition and Subtraction Thousands Number. MISEIC. (Surabaya: UNESA)
[21] Usman M H and Husaini M M 2017 IOSR J. Math. 13 1-4
[22] Nabie M, Akayuure P, Ibrahim-Bariham U and Sofo S 2018 J. Math. Educ. 9 169-182
[23] Mulyani M and Muhtadi D 2019 J. Penelit. Pembelajaran Mat. 12 I-16
[24] Santosa B, Budiyono B and Subanti S 2014 J. Elektron. Pembelajaran Mat. 2 88–98
[25] Ahmad A, Usodo B and Riyadi R 2017 J. Tatsjif 15 51-68
[26] Paolini A 2015 J. Effective Teaching 15 20-33
[27] Khwanchai K, Tanthip K and Toansakul S 2017 Educ. Res. Rev. 12 712-24
[28] Yenni R F 2013 J. Kreano 4 88-97
[28] Zulkardi and Putri R I 2010 J. Inov. Perekayasa Pendidik. 2 1–24
[29] Putri R I 2011 Int. Sem. Fourth Nat. Conf. Math. Educ. (Yogyakarta: UNY).
[30] Zulkardi and Putri R I 2006 Mendesain Sendiri Soal Kontekstual Matematika. Prosiding KNM 13. (Semarang: Universitas Negeri Semarang)
[31] Lestariningsih L, Anwar M and Setiawan A 2015 J. Math. Educ. 6 129-38
[32] Prahanma R, Zulkardi and Hartono Y 2012 J. Math. Educ. 3 1-16
[33] Bustang, Zulkardi, Darmowijoyo, Dolk M and Van Eerde D 2013 Int. Educ. Stud. 6 58-70
[34] Nursyahidah F, Ilma R and Somakim 2013 IndoMS-JME 4 212–23
[35] Nursyahidah F, Ilma R and Somakim 2014 Instructional Design of Subtraction Using PMRI Approach Based on Traditional Game. SEA-DR. (Palembang: Universitas Sriwijaya)
[36] Nursyahidah F, Saputro B A and Rubowo M R 2018 J. Res. Adv. Math. Edu. 3 13-24
[37] Nursyahidah F, Saputro B A, Albab I U and Aisyah F 2020 Mosharafa: J. Pendidik. Mat. 9 47-58
[38] Nursyahidah F, Saputro B A and Rubowo M R 2018 J. Phys.:Conf. Ser. 983012119
[39] Nursyahidah F, Saputro B A and Albab I U 2020 J. Phys.:Conf. Ser. 1567 022095
[40] Fahrurozi A, Maesaroh S, Suwanto I and Nursyahidah F 2018 J. Res. Adv. Math. Educ. 3 78-85
[41] Sivakumar R 2015 J. Educ. Psychol. Res. 5 5-10
[42] Dickson E, Jones K and Lund J 2016 Med. Educ. 5 1151-62
[43] Ockert D 2017 Teach. Eng. Technol. 20 66-81
[44] Yeo S 2018 Res. Math. Educ. 21 12-34
[45] Gravemeijer K & Cobb P 2006 Design Research from the Learning Design Perspective Educ. al Design Research eds van de Akker J, K Gravemeijer, S McKenney, and N Nieveen (London: Routledge) pp. 17-51
[46] Bakker A 2003 Design Research on How IT May Support The Development of Symbols and Meaning in Mathematics Education (Netherlands: Freudenthal Institute, Utrecht University)