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Enhancing Mathematical Representation Ability through ClassPoint-Assisted Situation-Based Learning

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ABSTRACT

Mathematical representation skills are an important aspect in supporting students' success in mathematics learning. This study aims to determine the influence of ClassPoint-assisted Situation-Based Learning (SBL) learning model on students' mathematical representation skills. The results of the pre-research show that students' mathematical representation skills are still relatively low in presenting real-situation problems in visual, symbolic, and verbal forms. This condition shows that there is a gap between the demands of mathematics learning that emphasizes the ability to represent and learning practices that are still conventional. This study uses a quantitative method with a quasi-experimental design in the form of a posttest only control group design. The research sample consisted of two classes selected using cluster random sampling. The research instrument is in the form of a test of mathematical representation ability on equation material and quadratic functions. Data analysis used the Independent Sample T-Test at a significance level of 5%. The results of the study showed that the value of sig. $0.007 < 0.05$, which indicates a significant influence of the application of the ClassPoint-assisted SBL learning model on students' mathematical representation skills. These findings provide an empirical contribution that ClassPoint-media-supported situation-based learning is effectively used as an alternative to mathematics learning to develop mathematical representation skills.



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Introduction

Mathematics is one of the branches of science taught at all levels of education, from kindergarten to college. In addition, mathematical concepts are very close to everyday life and we often encounter them. As one of the basic sciences that sustain human life, mathematics has

developed dynamically since it was first discovered, following the changes of the times. Its development never stops because mathematics is always needed in various aspects of life. This is an important reason why we need to study mathematics (Siagian, 2017). Mathematics is related to representation because everyone can learn mathematical concepts, one of which is through representation. In some ways, representation is seen as an important component of mathematical activities and a means to reinforce mathematical concepts (Sholehah et al., 2023).

Achieving mathematics learning goals requires mathematical skills. Representational capabilities are one of the five main NCTM standards (National Council of Teachers of Mathematics) for the purpose of learning mathematics. The understanding of mathematical concepts is greatly influenced by the ability of students to interpret and transform various forms of mathematical representations (Lesh et al., 1987). The ability of learners to convey mathematical concepts in a variety of ways is called mathematical representation ability. Representational skills can help learners solve math problems, because they are very important (Sabrina & Effendi, 2022). And Mathematical representation skills are an important process in understanding and solving mathematical problems, as they allow learners to connect mathematical ideas through various forms of representation such as visual, symbolic, and verbal (Goldin, 2002; Duval, 2006). In students' efforts to solve problems, mathematical ideas can be represented in a variety of ways, such as pictures, tables, graphs, numbers, letters, and symbols (Hardianti & Effendi, 2021).

Assessment results Programme for International Student Assessment (PISA) in 2018, Indonesia's mathematics score decreased compared to 2015, from 386 to 379. This score is still far below the average of the PISA mathematics score which reaches 489. In addition, the 2022 PISA assessment shows a decline in international learning outcomes due to the pandemic, with Indonesia's mathematics score decreasing by 13 points, namely 366 (Rahman et al., 2024). Furthermore, judging from the notes Trends in International Mathematics and Science Study (TIMSS) is an institution that measures and compares the mathematical abilities of students between countries, the mastery of mathematics of Indonesian students ranks 38th out of 42 countries. The average score obtained by Indonesian students is 386 and is still below the international average score of 500. This average score is still far below the average of other ASEAN countries such as Singapore, Malaysia, and Thailand (Fajriah et al., 2020). Based on the results of PISA and TIMSS research, it shows that the mathematical representation ability of students in Indonesia is still low (Rahman et al., 2024). Therefore, the researcher is interested in finding out the mathematical representation ability of students at Al-Huda Jatiagung Junior High School by providing a mathematical representation ability test.

The results of the mathematical representation ability test in grade VIII Usamah show that most students have not reached the Learning Goal Achievement Criteria (LGAC). There are still many students who get scores below the LGAC, while only a small number of students manage to achieve the LGAC in the questions given. The test results showed that out of 32 students, only 4 students obtained a score above the LGAC with a percentage of 12.5% and there were 28 students who obtained a score below the LGAC with a percentage of 87.5%. The Criteria for Achieving Learning Goals for students in mathematics subjects at Al-Huda Jatiagung Junior High School are 70. So this condition shows that in general, students' mathematical representation skills are still relatively low. The low ability of mathematical representation is one of the reasons for the application of a learning model that does not support the activeness of students during the learning process. The school applies a direct instruction learning model, but in practice, students have difficulty drawing conclusions. As a result, the application of the direct instruction learning model has not provided optimal results.

The use of learning models that are varied, interesting, and easy for students to understand is clearly an important part of the implementation of quality education. There are many learning

models spread across Indonesia, including inquiry learning, discovery learning, problem-based learning, project-based learning, and the latest is learning Situation-Based Learning (SBL). Learning model Situation Based Learning (SBL) is a situation-based learning model where students are given situations or questions that must then be associated with the material being studied. Learning model Situation Based Learning (SBL) is an exciting way to combine concepts, theorems, and skills learned in math learning with real-world situations. This approach is based on the principle that learners will be more engaged and understand mathematical concepts better. In Indonesia, the situation-based learning model has not been used evenly (Afni et al., 2024).

The SBL learning model applied in Indonesia is a study of the imbalance between the expected demands of the mathematics curriculum, with applications in the field or mathematics learning activities in schools. One of the demands of the curriculum is that students can solve problems, but in reality students still have difficulty in solving problems because they do not understand the problem completely. In other words, students are only limited to answering the problem with mathematical symbols. Therefore, a learning model was developed Situation Based Learning (SBL) applied by Isrok'atun & Rosmala (2018).

Situation-based or real-world learning can help learners build a meaningful understanding of mathematics, as concepts are learned through problems that are close to everyday experience (Gravemeijer & Doorman, 1999). Use of learning models Situation-Based Learning (SBL) in the teaching and learning process will be more interesting and interactive if learning media is used. Learning media is an important thing that affects the success of learning, because it functions as a non-verbal communication tool. Following technological advancements, today's learning media is very different. A few years ago, educators used very conventional media, such as whiteboards, printed pictures, cards, cardboard, model props, and more. However, today, learning media is dominated by audio, visual, and audio-visual technology. PowerPoint is an example of audio visual media because it can combine images, videos, text or writing. Educators typically use PowerPoint to display the material, which makes it possible to only allow one-way communication. However, PowerPoint It can be used in conjunction with other media or applications to generate two-way communication. One of the media that can be integrated with PowerPoint is ClassPoint, which was created by Inknoe in 2015 and allows learners to interact directly with slides PowerPoint in an attractive way according to the material being studied (Zulfa et al., 2023).

ClassPoint is an application PowerPoint integrated designed to make lessons engaging (Apriliana et al., 2024). This application can be used by educators to create quizzes in the learning process, while students can answer questions more interactively with questions Multiple Choice, short answer, competition mode, and more (Utari et al., 2023). The first step that educators must take is to download the application ClassPoint into his laptop or personal computer device. Once the app is downloaded and installed, ClassPoint will automatically connect with PowerPoint that is already on the device. Meanwhile, students do not need to download this application, because students can directly access ClassPoint through the browser by typing classpoint.app/join (Sundari et al., 2021).

ClassPoint Supporting the implementation of learning models Situation Based Learning (SBL) by helping students understand mathematical situations through interactive tools. With interactive features, such as Multiple Choice, word cloud, short answer, slide drawing, image upload, and whiteboard background (Sundari et al., 2021). This tool is also designed to be attractive and easy to use, creating a fun learning atmosphere so that it can increase students' interest in learning. Through this integration, students are encouraged to develop mathematical representation skills independently.

Learning model Situation-Based Learning (SBL) has several advantages, including: each learning activity requires students to interact with educators, group friends, and teaching media ClassPoint which makes students more actively participate in learning activities (Isrok'atun, 2014). In addition, before discussing a problem, students must gather information from a situation (Isrok'atun & Rosmala, 2018). In order to be able to present a situation into a mathematical symbol or model, learners must have mathematical representation skills to achieve learning objectives (Verina, 2023). Next, Students can develop the ability to compose question sentences in stages posing mathematical problem (Larawati et al., 2016). So that students are confident in expressing opinions, asking questions, or providing answers to questions (Bibah et al., 2023).

Based on the description above, mathematics is one of the basic sciences that plays an important role in human life and is taught at all levels of education. One of the goals of learning mathematics is to develop mathematical representation skills, which is the ability to present mathematical ideas in various forms such as visual, symbolic, and verbal. However, the results of international studies such as PISA and TIMSS show that the mathematical ability of Indonesian students is still relatively low, especially in solving contextual problems. This condition shows the need for learning innovations that are able to relate mathematical concepts to real situations. The Situation-Based Learning (SBL) learning model offers a situation-based learning approach that encourages learners to construct mathematical understanding through real context. The use of ClassPoint interactive media in SBL learning is expected to strengthen student engagement and provide a richer practice space for mathematical representation. From this explanation, the researcher designed the title of the study, namely "The Influence of ClassPoint-Assisted Situation-Based Learning (SBL) Learning Model on Mathematical Representation Ability".

Method

Types of Research

The data in this study is in the form of numerical data obtained from the results of students' answers, so this study uses a quantitative approach with a quasi experimental type. The research design used was a posttest only control group design. The research subjects consisted of two groups, namely the experimental group that was given treatment using the Situation-Based Learning (SBL) learning model assisted by ClassPoint and the control group that received learning with the direct instruction model.

Population and Sample

Population is a group that becomes a generalization area in research, consisting of objects or subjects with certain qualities and characteristics that are determined by the researcher to be studied and used as a basis for drawing conclusions (Scott, 2013). The population in this study is grade IX students of Al Huda Jatiagung Junior High School which are divided into 5 classes, namely Zubair, Thalhah, Abdurrahman, Sa'ad and Sa'id. In this study, the researcher used two classes as samples representing the existing population, namely the experimental class and the control class. Each sample class consisted of 32 students. The determination of the experimental class and the control class was carried out using the cluster random sampling Through the lottery method, by drawing lots for all class names in the population to determine which classes are used as experimental classes and control classes. Class IX Abdurrahman as an experimental class was given treatment using the assisted SBL learning model ClassPoint, while class IX Sa'ad as a control class was given treatment with a learning model direct instruction.

Research Instruments

Research instruments are means used in the process of collecting information. The measurement of mathematical representation ability was carried out by the researcher using tests in the form of essay questions.

Mathematical Representation Ability Test Questions

This study uses tests to measure the ability of mathematical representation, namely Posttest. Posttest It is carried out after the learning is completed or after the treatment is given. This test is in the form of a description (essay) question given to students. These questions are specifically designed to measure mathematical representation skills. The assessment of this test is carried out based on scoring guidelines that are in accordance with the answer key (Yunita et al., 2021).

Table 1. Mathematical Representation Ability Test Scoring Rubric

Score	Visual Representation	Symbolic Representation	Verbal Representation
0		No answer	
1	Creating an image/graphic but still incorrect	Creating a mathematical model but still incorrect	Explanation is written/explained but still wrong
2	Creating drawings/graphics but not complete	Creating mathematical models correctly but incorrectly in calculations	Explanations are written/explained mathematically but incomplete
3	Creating a complete image/graphic but still has an error	Making mathematical models correctly, doing calculations correctly, but getting the wrong solution	Explanations are written/explained mathematically and logically, but they are not systematically arranged
4	Create images/graphics correctly and completely	Creating mathematical models correctly, performing precise calculations, and getting the correct solutions	Explanations are written/explained mathematically, and arranged logically and systematically

The scoring criteria in the Table 1 use a scale of 0-4, so the score obtained is still a raw score. The score will then be converted to a score on a scale of 1-100 using the following formula:

$$\text{Final Score} = \frac{\text{Raw Score}}{\text{Maximum Score}} \times 100$$

Description:

Final score = the percentage value that is sought or expected

Raw score = Raw score obtained by the learner

Maximum score = maximum score amount

Before the implementation of the research, the test instrument was first validated by three validators who had competence in their fields, namely two Mathematics Education lecturers and one junior high school mathematics teacher. Validation is carried out to assess the feasibility of the instrument based on the aspects of indicator suitability, question grids and clarity in terms of language. The results of the assessment from two Mathematics Education lecturers showed that the question indicators were declared feasible with improvement, while the grid and question language were declared feasible and in accordance with the assessment

criteria. Furthermore, the validation was continued by the junior high school mathematics teacher validator, and the assessment results showed that the indicators, question grids and clarity in terms of question language were declared feasible and in accordance with the assessment criteria. After the instrument is declared feasible by the validators, a validity, reliability, difficulty level and differentiating power test is carried out through instrument testing. The test results showed that of the 10 questions tested, there were 5 questions that were declared suitable for use as a mathematical representation ability test instrument in this study.

Data Collection

The data collection technique in this study is using a written test. The written test is in the form of an essay, which aims to measure students' mathematical representation skills. The instrument is given after students participate in learning with the Situation-Based Learning model supported by ClassPoint.

Data Analysis

The data analysis in this study was carried out using the Independent Sample T-Test to find out the difference in the average mathematical representation ability between the experimental class and the control class. Before hypothesis testing is carried out, the data is first tested for prerequisites, including normality tests and homogeneity tests. The normality test is carried out using the Kolmogorov-Smirnov to ensure that the data is distributed normally (Azmi et al., 2025). The homogeneity test is carried out using the Levene's Test to find out the similarities of variance between groups (Sianturi, 2022).

The decision-making criteria in the prerequisite test is that the data is declared normal and homogeneous if the significance value is greater than 0.05. Test results Levene's Test shows that the variance of the two groups is homogeneous ($\text{sig.} > 0.05$), so that hypothesis testing using the results of the t-test on the line equal variances assumed. Furthermore, hypothesis testing is carried out at a significance level of 5% with the criterion that it is rejected if the significance value $H_0 \text{Sig. (2-tailed)}$ less than 0.05. The interpretation of the results of the t-test was based on a comparison of significance values and average differences between the two groups to determine whether or not there was an influence on the application of the learning model Situation-Based Learning (SBL) assisted ClassPoint on the mathematical representation ability of students (Wicaksono et al., 2023).

Research Findings

Descriptive Analysis

The results of the descriptive analysis showed that the average mathematical representation ability of students in the experimental class was 76.97 higher than the control class of 68.00. Prerequisite tests show that the data is distributed normally and homogeneously. The results of the Independent Sample T-Test showed a value of $\text{Sig. (2-tailed)} < 0.05$, so it can be concluded that there is a significant influence of the Situation-Based Learning (SBL) learning model assisted by ClassPoint on students' mathematical representation skills. The results of the descriptive analysis are presented as follows:

Table 2. Descriptive Analysis

		Descriptives	
Classes		Statistic	Std. Error
Experiment	Mean	76.97	2.299
	95% Confidence	Lower Bound	72.28
	Interval for Mean	Upper Bound	81.66
	5% Trimmed Mean		77.41
	Median		77.00
	Variance		169.128
	Hours of deviation		13.005
	Minimum		46
	Maximum		100
	Range		54
	Interquartile Range		15
	Skewness		-.537 .414
Control	Kurtosis		.075 .809
	Mean	68.00	2.211
	95% Confidence	Lower Bound	63.49
	Interval for Mean	Upper Bound	72.51
	5% Trimmed Mean		68.06
	Median		68.00
	Variance		156.452
	Hours of deviation		12.508
	Minimum		46
	Maximum		89
	Range		43
	Interquartile Range		20

Based on the results of the descriptive analysis in **Table 2**, the experimental class had an average value of mathematical representation ability of 76.97 with a standard deviation of 13.005. A median score of 77.00 indicates that most students score around the average. The minimum and maximum scores were 46 and 100 respectively with a range of 54 and an interquartile range (IQR) of 15, which showed a relatively even distribution of data. A skewness value of -0.537 indicates that the data distribution tends to be skewed to the left, but still close to a symmetrical distribution, while a kurtosis value of 0.075 indicates that the data distribution is close to normal.

The control class had an average value of 68.00 with a standard deviation of 12.508, which indicates a relatively comparable distribution of data to the experimental class. The median score was 68.00, with a minimum score of 46 and a maximum of 89, resulting in a range of 43 and an IQR of 20. A skewness value of -0.158 indicates a relatively symmetrical distribution of data, while a kurtosis value of -0.772 indicates a data distribution that tends to be flatter than the normal distribution. Descriptively, these results show that the mathematical representation ability of students in the experimental class is higher than that of the class applying the Situation-Based Learning (SBL) learning model assisted by ClassPoint to provide better results for the mathematical representation ability of students compared to direct instruction learning.

Prerequisite Test

Normality Test

Normality tests are performed on the data of mathematical representation ability to see whether the data sample taken is normally distributed or not. The provision is that if the p-value > 0.05 , then the data is categorized as normally distributed, while the p-value ≤ 0.05 , then the data is considered not normally distributed. The normality test in this study used the Kolmogorov-Smirnov test with a significant level of 5% or 0.05 and was analyzed with the help of the SPSS 25 program. The results of the normality test can be presented as follows:

Table 3. Kolmogorov-Smirnov Normality Test

Tests of Normality			
Classes	Kolmogorov-Smirnova		
	Statistic	df	Sig.
Representasi_Matematis	Eksperimen	.104	32
	Control	.094	32

The results of the posttest normality test of mathematical representation ability obtained a p-value or sig. in the experimental class it was 0.200 and in the control class it was 0.200. Thus, it can be stated that the mathematical representation ability data is normally distributed because each class obtains a p-value > 0.05 .

Homogeneity Test

Homogeneity tests were performed on mathematical representation ability data to see whether the sample data taken came from a population of the same variance or not. The stipulation is that if the p-value > 0.05 , then the data is categorized as homogeneous, while the p-value ≤ 0.05 , then the data is considered inhomogeneous. The homogeneity test in this study uses the Levene's Test with a significant level of 5% or 0.05 with the help of the SPSS 25 program. The results of the homogeneity test can be presented as follows:

Table 4. Levene Homogene's Test

Test of Homogeneity of Variance					
	Levene Statistic	df1	df2	Sig.	
Mathematical_Representation	Based on Mean	.034	1	.62	.855
	Based on Median	.034	1	.62	.855
	Based on Median and with adjusted df	.034	1	.61.853	.855
	Based on trimmed mean	.033	1	.62	.856

The results of the homogeneity test obtained a p-value or sig. by 0.855. Based on the homogeneity test criteria with a significant level of 5% or 0.05, provided that if the p-value > 0.05 , the data is declared homogeneous. On the other hand, if the p-value < 0.05 , the data is declared inhomogeneous. Because the p-value or sig. by 0.855 > 0.05 , then it can be concluded that the data on mathematical representation ability is homogeneous or the same.

Prerequisite tests are performed to ensure that the data meets the necessary assumptions before hypothesis testing using parametric tests. If the results of the normality test show that the data is not normally distributed or the homogeneity test results show that the data variance is not homogeneous, then the data analysis cannot be continued using a parametric test. In these conditions, the researcher used a non-parametric statistical test as an alternative, namely the Mann-Whitney U test. However, because the results of the normality and homogeneity test in

this study showed that the data was normally distributed and had a homogeneous variance, the hypothesis test was continued using the Independent Sample T-Test.

Hypothesis Test

Independent Sample T-Test

The results of the Independent Sample T-Test analysis showed a significance value of 0.007 which was below the significance limit of 0.05. Thus H_0 it was rejected, which means that there was a statistically significant influence between the average mathematical representation ability of students in the experimental class and the control class. These findings show that the application of the Situation-Based Learning (SBL) learning model assisted by ClassPoint has an influence on students' mathematical representation skills. The following are the results of the Independent Sample T-Test.

Table 5. Independent Sample T-Test

Independent Samples Test										
	Levene's Test for Equality of Variances			t-test for Equality of Means						
	F	Say.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
								Lower	Upper	
Mathematical Representation	Equal variances assumed	.034	.855	2.812	62	.007	8.969	3.190	2.593	15.345
	Equal variances not assumed			2.812	61.906	.007	8.969	3.190	2.592	15.345

Discussion

Application of the assisted SBL learning model ClassPoint provide opportunities for students to develop mathematical representation skills through the presentation of contextual situations, group discussions, and the use of interactive media. Features ClassPoint facilitate learners in presenting answers in verbal, symbolic, and visual form directly, thereby encouraging active engagement and deeper understanding. The findings of this study reinforce the results of previous research [Rahman et al. \(2024\)](#) which states that situation-based learning and supported by interactive media can improve mathematical representation skills ([Afni et al., 2024](#)). The results of the study show that the application of the learning model Situation-Based Learning (SBL) assisted ClassPoint has a significant effect on students' mathematical representation skills. These findings reinforce the view that contextual situation-based learning can help students connect mathematical concepts with real experiences, thereby facilitating the process of mathematical representation both visually, symbolically, and verbally.

Theoretically, the SBL model is aligned with the constructivist approach which emphasizes that knowledge is actively built by learners through meaningful interactions with the environment and situations. The presentation of situation-based problems encourages students to interpret information, model the situation into mathematical form, and communicate the results of their thinking. Thus, SBL not only supports problem solving, but also specifically

develops mathematical representation capabilities. The use of ClassPoint interactive media in SBL learning acts as a means of supporting mathematical representation. Interactive features on ClassPoint allow learners to present answers directly in a variety of forms, such as symbols, pictures, and verbal explanations. This provides space for students to explore and improve their mathematical representations more actively than conventional learning.

The findings of this study are in line with the results of previous research [Rahman et al. \(2024\)](#) which states that situation-based learning and the use of interactive media can improve students' mathematical representation skills ([Apriliana et al., 2024](#)). The difference between this study and previous research lies in the integration of the SBL model with the media ClassPoint which is specifically focused as a means of strengthening mathematical representations, not just an evaluation tool or quizze. Furthermore, it is supported by research by [Lestari et al. \(2024\)](#) which shows that stages like this strongly support the improvement of mathematical representation skills. In its application, the SBL model requires the active involvement of students from the beginning to the end of the learning process ([Sundari et al., 2021](#)). Students are directed to analyze the situation, identify relevant information, then change or represent the data into mathematical form according to the characteristics of the given question. Therefore, practically from the results of this study, it provides implications for mathematics teachers to apply the Situation-Based Learning (SBL) learning model assisted by interactive media as an alternative to contextual and student-centered learning. Teachers are expected to be able to design learning situations that are relevant to real life and utilize learning technology to facilitate the development of students' mathematical representation skills.

Conclusion

Based on the results of the research and discussion, it can be concluded that the Situation-Based Learning (SBL) learning model is effective in improving the mathematical representation ability of junior high school students in equation and quadratic function materials. This effectiveness can be seen in the ability of students to change contextual situations into visual, symbolic, and verbal representations in a more systematic manner than direct instruction learning. In particular, the application of the SBL model contributes to the development of mathematical representation skills because it places real situations as the starting point for learning. Through the stages of situational analysis, modeling, and discussion, students are trained to construct and transform mathematical ideas into various forms of representation, so that SBL not only serves as a problem-solving model, but also as an approach that specifically supports the process of mathematical representation.

The use of ClassPoint interactive media in learning serves as a means of mathematical representation, not just a quiz or evaluation tool. ClassPoint's interactive features allow learners to express their math understanding directly through pictures, symbols, and verbal explanations, providing a more diverse and responsive space for the exploration of representations throughout the learning process. The combination of the SBL model and ClassPoint media has proven to be complementary in improving students' mathematical representation skills. SBL provides a meaningful situation-based learning framework, while ClassPoint reinforces the representation process through interactive media that facilitates active engagement of learners. These findings provide a theoretical contribution that the integration of situation-based learning with interactive media is effectively used to develop mathematical representation skills, especially at the junior high school level. Based on these findings, the ClassPoint-assisted SBL learning model is recommended as a contextual and student-centered mathematics learning alternative. Further research is suggested to examine the effectiveness of this model on other mathematical

materials, different levels of education, and other mathematical abilities in order to expand the generalization of research results.

Conflict of Interest

The authors declare that there is no conflict of interest.

Authors' Contributions

L.I.L. contributed to the development of the research title, formulation of the introductory sentences, and the basic conceptualization of the study. F. and S.P.N. actively participated in drafting the manuscript, composing sentences, conducting tests, and performing the research directly at the school. All authors have read and approved the final version of this manuscript. The percentage contributions for conceptualization, drafting, and revising the article are as follows: L.I.L.: 70%, F.: 15%, and S.P.N.: 15%.

Data Availability Statement

The authors declare that the data supporting the findings of this study will be made available by the corresponding author, L.I.L., upon reasonable request.

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