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The Effect of Innovative Learning on Student Achievement in Indonesia: A Meta-Analysis

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Abstract

This study aims to describe the effect of innovative learning on student achievement through meta-analysis. Data collection was carried out by documenting research produced from various sources collected via the internet in accordance with the title of this research. These articles were published from 2012 to 2022, from journal articles in Indonesia. This article that discusses the effect of innovative learning on student achievement is focused on research that has been carried out in Indonesia and analyzed with a quantitative approach, namely describing data in the form of sample size, standard deviation, and average. A learning process by utilizing innovative learning methods consisting of Discovery learning, Inquiry learning, Flipped classroom, Project based learning, Blended learning with blogs, Game based and Self organized learning environments (sole). The articles used are those published in journals indexed by Google Scholar. The design of the analysis used the average with the random effect method with Restricted ML. The analysis uses JASP software to calculate the average difference in the aggregate, draw the forest plot, and its publication bias. The results of the analysis obtained from 50 articles that match the criteria show that there is a significant increase in student achievement with innovative learning, so that innovative learning affects student achievement in Indonesia. The study was declared free of potential bias as evidenced by the results of the Forest Plot and compared the results of the Funnel Plot using the Trim and Fill method. This study recommends the use of learning innovations both in the education system in Indonesia as well as in the global education system.

Keywords: Innovative learning, Learning achievement, Meta-analysis.

Introduction

Schools are educational institutions that have a very important role in improving the quality of human resources in a country. Therefore, schools as educational institutions must always adapt and adapt to existing dynamics and developments, both in terms of technology, human resources such as teachers and students as well as learning. Learning is a teaching and learning process in which there is a positive interaction between teachers and students in an effort to achieve the learning goals themselves (Mustasyfiyah, 2019). This is stated in the Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System that learning is a process of interaction between students and educators and learning resources in a learning environment. Schools as educational institutions must also adapt to the changes that occur, one of which is the COVID-19 pandemic which has made all aspects of life adapt, including the world of education. Learning before the pandemic was carried out face-to-face directly in the classroom, with this pandemic forcing all teachers in this context in Indonesia to be creative in making more innovative learning by using various learning strategies, utilizing technology and applying existing learning models so that the teaching and learning process is more effective (Herwin et al., 2022; Astuti et al., 2022; Ilyas et al., 2022). This is quite a challenge for teachers because it must be done online, especially in an effort to increase learning motivation and student achievement.

Learning achievement is something that has been achieved as an effort that has been made by students (Putra & Purwasih, 2016). One way to improve student achievement is to raise students' learning motivation which is influenced by the use of interesting and fun learning models as a supporting factor for the learning process. Therefore, teacher skills in managing the classroom are very important so that students always have the will to learn and get satisfactory learning outcomes or learning achievements. In the 21st century, teachers are not only required to be able to take advantage of existing technology, but teachers must also be able to make various innovations in learning. One of them is using innovative learning models in the teaching and learning process in the classroom (Marzano, 2001; Marzano & Toth, 2013; Mustasyfiyah, 2019).

Innovative learning models must be understood by teachers as an effort to improve student achievement and learning outcomes, where teachers must also have skills in

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mastering and utilizing these learning models. Teachers must provide more interesting learning innovations with all their creativity. This is in accordance with what is stated in the Regulation of the Minister of National Education of the Republic of Indonesia No. 41 of 2007 concerning Standards for the Educational Process which states that in the implementation of education it is necessary for teachers to develop the potential and creativity of students. The development of the potential and creativity of students can be done through the use of innovative learning models (Farman & Chairuddin, 2020). Regulation of the Minister of National Education of the Republic of Indonesia number 41 of 2007 concerning procedures for providing education also requires teachers to be able to develop the potential, creativity, and innovation of students. Meanwhile, based on the Regulation of the Minister of Education and Culture of the Republic of Indonesia number 65 of 2013, the characteristics of the teaching and learning process at each level of education are related to content standards. The content standard contains a conceptual framework for the teaching and learning process originating from the capabilities and limitations of material selection. To achieve these goals, teachers need to understand and create various learning models (Ashari & Basuki, 2021).

The challenges in utilizing innovative learning models include not all teachers having a good understanding of existing learning innovation models, so they tend to still carry out traditional and as-is-it is learning activities. This will lead to a lack of interest and motivation of students in learning, especially during the pandemic (Farman & Chairuddin, 2020). Of course, this is a challenge as a teacher where they must first have the interest and motivation to learn for life as an ideal educator. With the motivation to innovate learning by understanding and applying existing learning models, it is hoped that it will also motivate students to improve their learning achievements. So, what is most needed here is the exemplary element of the spirit that the teacher can transmit to his students.

Examples of innovative learning that have been applied from several studies on the effectiveness of learning to improve student achievement with learning models that have been widely developed, including Launching the Instagram account of the Indonesian Ministry of Education and Culture's Learning House Platform. The following are six innovative learning models: Discovery learning, Inquiry learning, flipped classroom, Project based learning, Blended learning, Game-based and Self organized learning environments (sole). In this study, the six innovative learning models were used as the basis for innovative learning by conducting a meta-analysis.

Innovative learning is a very important issue in the education system. Regulations in Indonesia provide instructions so that the learning process is more directed at maximum student development through innovative learning models. In fact, not only in the education system in Indonesia, abroad have also made a lot of use of innovative learning. Therefore, a variety of innovative learning lessons have been applied in various countries (Serdyukov, 2017; Montonen & Eriksson, 2013). This is certainly directed at one goal, namely to improve the quality of learning.

Based on the description above, the researcher is interested in conducting a meta-analysis, the purpose of this study is to describe the effect of innovative learning on student achievement. This research is expected to provide an overview and strengthen understanding to policy makers as a guide in education policy making and by teachers as education practitioners how important innovation is in classroom learning, so that it can be used as an effort to improve learning outcomes or student achievement.

Method

Research Design

This study is a meta-analysis that summarizes the results of similar studies and concludes with global conclusions. The theme of this research is the effect of innovative learning on student achievement in Indonesia. The data population in this article is a study of all studies that compare the results of a learning process by utilizing innovative learning methods consisting of Discovery learning, Inquiry learning, Flipped classroom, Project based learning, Blended learning with blogs, Game-based and Self organized learning environments (soles).

The articles analyzed are articles published in journals in Indonesia from 2012 to 2022. The article collection technique uses internet assistance through Google Scholar as a search engine that is connected to various journal portals and indexing institutions. This strategy is used to collect the widest possible data in order to obtain data that can represent the themes studied comprehensively and avoid bias.

Inclusion and Exclusion Criteria

The inclusion criteria in this study based on articles published from 2014 to 2022 are: a) Articles discussing the effect of innovative learning on student achievement in Indonesia; b) Articles are analyzed quantitatively; c) Experimental research design; d) The article describes data in the form of sample size, standard deviation, and average; e) Articles published in journals indexed in Google Scholar; f) Articles published in Indonesian journals; g) The maximum minimum scale is 0-100. Articles that do not meet the seven inclusion criteria will be included in the pool of articles that fall under the exclusion criteria.

Exclusion criteria are criteria that explain that the article does not meet the inclusion criteria and will not be included in the meta-analysis process. Researchers collected a total of 258 articles with themes relevant to the research focus.

However, only 50 articles were found that wrote data related to the number of samples, standard deviation, and the mean of the research results which became the basis for finding the conclusions of this study. If these data are not available (in the sense that there is no sample size, standard deviation, and mean result), then the article will be omitted from the sample set to be analyzed.

Data Collection

The search for publication documents was carried out from February to April 2022. Overall, a search by keyword obtained as many as 502 articles published online. The keywords used to search the data are innovative learning (Discovery learning, Inquiry learning, Flipped classroom, Project based learning, Blended learning, Game-based and Self-organized learning environments), student achievement and student learning outcomes. Then the articles that appear are downloaded and sorted that meet the inclusion requirements as previously mentioned, namely (120 articles). Then the articles were checked for completeness of information in the form of sample size (N), mean or average value (M), and standard deviation (S) so that the total articles used were 50. Demographics related to innovative learning, location and year of research in articles that include inclusion criteria are shown in Table 1.

Tabel 1: Demographics of the Research Sample

		n	%
Innovative learning	Discovery learning	7	14 %
	Inquiry learning	5	10 %
	Flipped classroom	3	6 %
	Project based learning	13	26 %
	Blended learning	12	24 %
	Game based	1	2 %
	Self-organized learning environments	9	18 %
Region	Western Indonesia	36	72 %
	Central Indonesia	14	28 %
School level	Elementary school	12	24 %
	Junior high school	12	24 %
	Senior high school	20	40 %
	University	6	12 %
Years	2012	1	2 %
	2014	3	6 %
	2015	2	4 %
	2016	6	12 %
	2017	4	8 %
	2018	5	10 %
	2019	6	12 %
	2020	10	20 %
	2021	11	22 %
	2022	2	4 %

Data Analysis

This study uses a Random Effect model with the aim that the research results can be generalized to the population (not only valid for concluding the findings). The requirement to choose the random effect model is heterogeneity information I2> 25%. The type of meta-analysis in this study is the average that looks at the effect of innovative learning on student achievement. The data obtained has a variation interval (difference in the minimum and maximum values) from 0 to 100 so it does not require standardization. The following is a formula or formula for finding the weighted mean effect size where indicates the standard deviation of the x-th data, and N is the research sample size. The analysis process was carried out using JASP software to assist in calculating heterogeneity and publication bias (funnel plot). Thus, it can be concluded that the influence of innovative learning on student achievement in Indonesia. The data entered are SE and ES as effect sizes and to produce a forest plot. The method chosen is Restricted ML (random effect).

Findings

This study analyzed 50 research results taken from 258 articles. The learning outcomes referred to in this research are student achievement in various domains, subjects, and levels of education. The results of the study were carried out by looking at the experimental group after being given treatment or the results of the student post-test. Based on the sample size, mean and standard deviation data, researchers can produce an effect size and standard error as presented in Table 2.

Based on the data in Table 2, heterogeneity test has been carried out, this test is used to show the suitability of the model with the data. This study takes the average effect model with Restricted ML so that the data must meet the heterogeneity assumption where the true effect sizes of all studies are not the same. The heterogeneity assumption can be identified by looking at the Residual heterogeneity estimates (I2). The result of the I2 value shows the proportion of variation in the summary effect size on a scale of 0% to 100%. This effect size is used to determine the effect so as to reduce research from measurement errors and other artifacts (Hunter, 2004). Effect size results in statistical standardization of study findings so that the resulting numerical values can be interpreted consistently across all variables and measures of interest (Lipsey, 2001). The data collected in this study is shown in Table 3 which produces I2 = 97.157% > 25%, meaning that there is heterogeneity where the true effect size of all studies is not the same so that the selection of the average effect model is in

Table 2: Summary of research data, effect size and standard error

No	*Studies*	*Authors*	*Years*	*N*	*Mean*	*S*	*SE*	*ES*
1	Study 1	(Nurhadiyati et al., 2020)	2021	20	61	14,2	3,174769	61
2	Study 2	(H. Putra & Purwasih, 2016)	2015	43	85,81	3,77	0,57492	85,81
3	Study 3	(Farhan & Retnawati, 2014)	2014	35	80	11,39	1,925261	80
4	Study 4	(Laili, 2017)	2016	30	66,57	5,25	0,958514	66,57
5	Study 5	(Manggabarani & Masri, 2016)	2016	24	83,5	8,3	1,69423	83,5
6	Study 6	(Hadiansyah, 2017)	2017	30	86,07	5,258	0,959975	86,066
7	Study 7	(Widyasari & Rafsanjani, 2021)	2021	30	71,63	12,9	2,355024	71,63
8	Study 8	(Nudin et al., 2021)	2021	60	66,33	8,785	1,134139	66,33
9	Study 9	(Nugraha et al., 2020)	2020	12	80,83	7,93	2,289194	80,83
10	Study 10	(Khotimah, 2019)	2019	22	80	7,904	1,685138	80
11	Study 11	(Asrifah et al., 2020)	2020	20	77,9	5,17	1,156047	77,9
12	Study 12	(Thoyib et al., 2021)	2021	15	64	9	2,32379	64
13	Study 13	(Pradana & Harimurti, 2017)	2017	30	81,89	6,2	1,13196	81,89
14	Study 14	(A. P. Putra, 2015)	2019	30	74,87	6,909	1,261431	74,867
15	Study 15	(Prihatini, 2020)	2017	70	77,46	8,988	1,074271	77,46
16	Study 16	(Sandi, 2005)	2012	76	77,8	9,3	1,066783	77,8
17	Study 17	(Manafe et al., 2022)	2022	31	56,92	17,5	3,143093	56,92
18	Study 18	(Saragih & Tanjung, 2021)	2021	27	81,63	7,86	1,512658	81,63
19	Study 19	(Suntusia et al., 2019)	2019	45	66	12,45	1,855936	66
20	Study 20	(Bahari et al., 2018)	2018	32	80	11,52	2,036468	80
21	Study 21	(Mega Farihatun et al., 2019)	2019	33	79,84	7,56	1,316027	79,84
22	Study 22	(Pamungkas et al., 2017)	2017	36	78,4	8,91	1,485	78,4
23	Study 23	(Azmi & Rahayu, 2016)	2016	40	79,83	6,72	1,062525	79,83
24	Study 24	(Nurqomariah, 2015)	2015	24	75,13	8,88	1,812622	75,13
25	Study 25	(Afriani & Nalim, 2021)	2021	24	80,42	13,35	2,724037	80,42
26	Study 26	(Fitriani, 2018)	2018	30	84,34	8,8	1,606653	84,34
27	Study 27	(Nilasari et al., 2016)	2016	22	82,27	3,285	0,700364	82,27
28	Study 28	(Amiyani & Widjajanti, 2019)	2019	30	84,76	8,94	1,632213	84,76
29	Study 29	(Maryani & Widjajanti, 2021)	2020	36	79,81	10,74	1,79	79,81
30	Study 30	(Juraini et al., 2017)	2016	20	74,2	11,35	2,537937	74,2
31	Study 31	(Chusni & Edy, 2014)	2014	36	80	4,522	0,753667	80,055
32	Study 32	(Ibrahim & Suardiman, 2014)	2014	33	74,03	5,763	1,00321	74,03
33	Study 33	(Sahara & Sofya, 2020)	2020	29	85,9	6,31	1,171738	85,9
34	Study 34	(Riyanti & Setyawan, 2021)	2021	18	86,69	4,41	1,039447	86,69
35	Study 35	(Damayanti et al., 2020)	2020	30	67,28	7,27	1,327314	67,28
36	Study 36	(Arnata et al., 2020)	2020	36	79,38	7,76	1,293333	79,38
37	Study 37	(Nareswari, 1967)	2018	30	85,33	5,88	1,073536	85,33
38	Study 38	(Harahap, 2021)	2021	36	87,25	9,802	1,633667	87,25
39	Study 39	(Simbolon & Situmorang, 2018)	2018	30	71,1	12,34	2,252965	71,1

No	*Studies*	*Authors*	*Years*	*N*	*Mean*	*S*	*SE*	*ES*
40	Study 40	(Batubara et al., 2016)	2016	30	72,66	10,37	1,893294	72,66
41	Study 41	(Marliyah, 2019)	2019	55	77,82	8,037	1,083709	77,82
42	Study 42	(Linda Sari, Rita Juliani, 2016)	2020	30	73	6,87	1,254285	73
43	Study 43	(Mangar & Suriani, 2020)	2020	30	80,13	7,43	1,356526	80,13
44	Study 44	(Asy'ari, 2021)	2021	24	76,54	12,3	2,510727	76,54
45	Study 45	(Widiastuti et al., 2018)	2018	32	85,72	9,081	1,605309	85,718
46	Study 46	(Mandang & Tulandi, 2020)	2020	22	81,81	6,13	1,30692	81,81
47	Study 47	(Rahmawati et al., 2020)	2020	15	52,33	8,73	2,254076	52,33
48	Study 48	(Situmorang, 2017)	2021	28	81,55	4,17	0,788056	81,55
49	Study 49	(Astuti, 2021)	2021	23	83,3	5,094	1,062172	83,304
50	Study 50	(Setyorini et al., 2022)	2022	19	82,11	12,72	2,918168	82,11

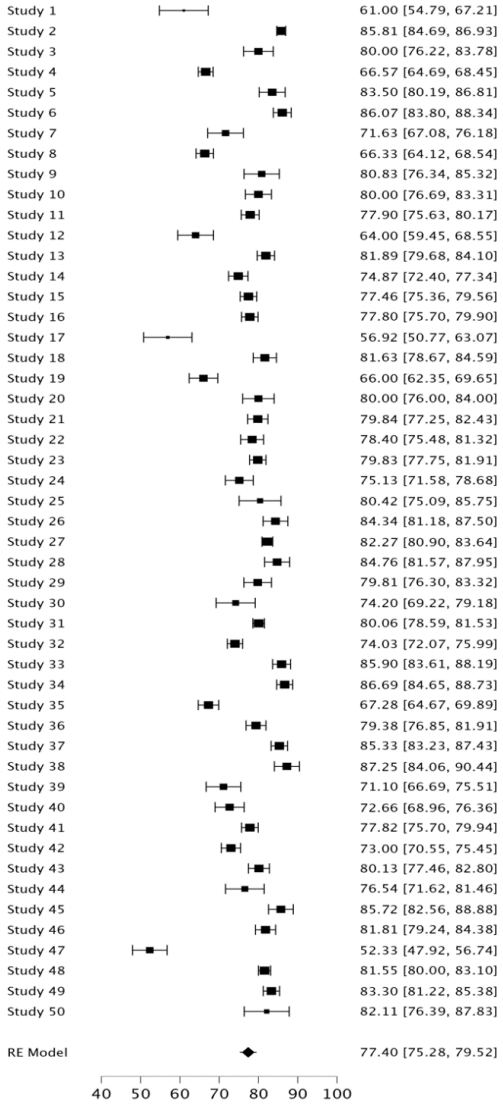

Fig. 1: Forest Plot

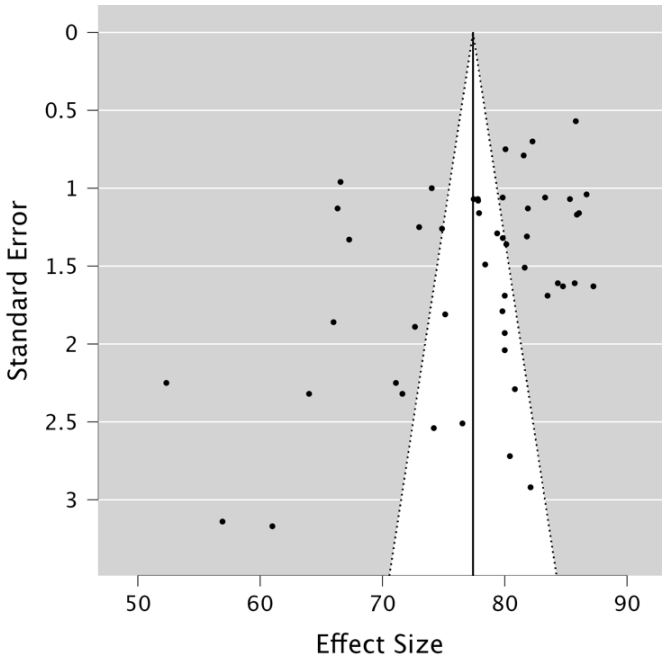

Fig. 2: Funnel Plot Trim and Fill method

accordance with the criteria. Then to conclude the aggregate or overall effect can be seen in the Forest Plot in Figure 1.

The data in the Forest Plot shows that the summary effect is 77.40. It can be interpreted that with the innovative learning method, student learning outcomes on average are 77.40. In addition, with a confidence interval of 0.95%, it is known that the summary effect range is 75.28 to 79.52. Furthermore, publication bias is needed to demonstrate the validity of the conclusions in the study (Arlinwibowo et al., 2022). Publication bias detection can be detected using the Trim and Fill or Fail-safe methods. The results of Trim and Fill and Fail-safe data performed with the help of JASP software are shown in Figure 2.

Figure 2 shows that there are no open points in the Funnel Plot Trim and Fill method. This shows that research on the effect of innovative learning on student achievement is free from potential bias. This argument is strengthened by the results of the initial Forest Plot in Figure 1 which will be compared with Figure 2. The Funnel Plot uses the Trim and Fill method.

Discussion

Innovation is a change made for the better, while learning is a series of activities designed to teach students according to the goals to be achieved. Therefore, learning innovation is a learning process to design, develop and manage students creatively, and apply various methods in a better direction to create an atmosphere and learning process that is beneficial for students. Teachers need to innovate in learning. Innovation in learning is very important to increase the effectiveness of learning for both teachers and students (Senen et al., 2021; Herwin et al., 2022; Sartono et al., 2022; Rahayu et al., 2022; Pujiastuti et al., 2022). With learning innovation, learning will be more meaningful. Teachers have a very important role in developing learning activities (Tjabolo & Herwin, 2020; Herwin & Dahalan, 2022). Teachers must have the will and ability to create innovations in learning. This will be very beneficial for both students and teachers themselves.

Teachers will gain a greater understanding and broad insight into new learning methods, teaching techniques, how to treat students, and others which will ultimately increase their ability to become quality teachers (Hapsari & Fatimah, 2021). The teacher is the most important agent in educating students and in bringing about change and innovation in educational practice, the failure of education may be because the teacher does not carry out a learning innovation (Bakkenes et al., 2010).

There are seven learning methods included in innovative learning, namely discovery learning, Inquiry learning, flipped classroom, project-based learning, blended learning with blogs, Game-based and Self-organized learning environments. Therefore, in this study focused on the seven methods and their effect on student achievement. Analysis using meta-analysis can be carried out in several steps, including first, testing the heterogeneity of the effect size and standard error, this test is used to show the suitability of the model with the resulting data from the value I2 = 97.157% > 25%, meaning that there is heterogeneity where the true effect size is all studies are not the same so that the selection of the mean effect model is in accordance with the criteria. The data in the Forest Plot shows that the summary effect is 77.40, meaning that by using innovative learning, the average student learning outcome is 77.4.

Second, conduct an investigation of publication bias. Publication bias detection can be detected using the Trim and Fill or Fail-safe methods. This research focuses more on the trim and fill method. Based on studies conducted that the Trim and Fill method can create funnel plots that include both observational and imputation studies, this allows researchers to see how effect sizes change when the included studies are included. The visible effect will be declared valid if the shift in effect size is narrow. Thus, researchers can see a shift in effect size when unpublished research is included in the analysis (Retnawati et al, 2018).

Articles from various studies that were collected to conduct this meta-analysis are articles related to the influence of innovative learning on student achievement conducted in Indonesia, of course research from different spaces and times and concludes various research results on this topic. This is a strong basis for more convincing that indeed the results of the research used in this meta-analysis can be applied in a wider scope. The conclusions of this meta-analysis are general findings. Findings related to the effect of innovative learning to improve student achievement can be applied by other teachers in Indonesia and even in other countries.

Conclusion

The results show that there is a significant increase in student achievement with innovative learning, so that innovative learning affects student achievement in Indonesia. This statement is evident from the results of the forest plot with a significance level of 5% which has an aggregate value of 77.40 and a summary effect range of 75.28 to 79.52. This means that with the innovative learning method, student learning outcomes on average are 77.40. The study was declared free of potential bias as evidenced by the results of the Forest Plot and compared the results of the Funnel Plot using the Trim and Fill method. This means that learning methods that are included in innovative learning (Discovery learning, Inquiry learning, flipped classroom, Project based learning, Blended learning, Game-based and Self-organized learning environments) can improve student achievement in Indonesia. The research findings provide very in-depth information and can be used by teachers to develop and implement innovative learning in the teaching and learning process in the classroom so that it can always improve student achievement including critical aspects and student potential can be honed well, creating fun and not boring learning.

Suggestion

This study suggests the importance of inventive learning for the learning process of students in schools. This is evidenced in this finding that learning outcomes will be maximized by maximizing innovative learning in the classroom. Because this innovative learning is very beneficial for teachers and students, it is hoped that this learning will be applied continuously in the education process in schools.

Limitation

This research is still limited to studies on innovative learning on student achievement in Indonesia. Further research can conduct research that does not only focus on the scope in Indonesia but also in other countries. The areas that were successfully reached from this research were only the western part of Indonesia and central Indonesia, so it needs to be studied again in the eastern part of Indonesia. The object of research also does not have to focus on student achievement but can conduct research that connects innovative learning with learning interest, students' critical thinking skills and so on. Further researchers can also conduct research that only focuses on elementary school, junior high school, high school or college students.

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