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Article

Socio Science-Teaching on Madura Bull Racing Context: Finding Correlation Between Numeracy Literacy and Science Conceptual Understanding

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ABSTRACT

The Madura bull racing as the local wisdom of Madura can be studied scientifically to train students in numeracy literacy and understanding concepts. Numerical literacy is important for students because it includes basic skills for obtaining new information. Numerical literacy is not only needed in mathematics, but is also needed to learn concepts in science subjects. The purpose of this study was to determine the relationship between numeracy literacy skills and students' understanding of science concepts towards the concept of motion and force in socio-science teaching in the Madura bull racing context. Data analysis used Spearman's rank correlation test. The results showed a significance value of 0.000 <0.05 with a correlation coefficient of 0.528, which means that there is a positive relationship with moderate closeness between numeracy literacy skills and understanding of the science concept of motion and force socio-science teaching in the Madura bull racing context with a determination coefficient of 0.278. The conclusion of this study is that the correlation of numeracy skills on students' understanding of science concepts regarding motion and force socio-science teaching in the Madura bull racing context is 27.88% and 72.12% is influenced by other factors, such as multi-representational skills, HOTs, etc. This research has implications for improving science learning designs using the context of the local wisdom of Madura bull racing in training science conceptual understanding and numeracy literacy skills.

INTRODUCTION

In the current Merdeka curriculum, Natural Sciences (IPA) is a subject that studies a series of events, facts, concepts, and generalizations related to phenomena that occur in the natural environment and social society. The objectives of studying IPA are (1) to understand the concept of material related to natural life, society and its environment; (2) to have basic competencies in logical, critical, and systematic thinking, to arouse curiosity, inquiry, problem solving, and skills in community life; (3) to have commitment, high awareness, character towards natural and social values; and (4) to have the ability to communicate, cooperate, and compete in a pluralistic society, both at the local, national, and global levels (Verawati & Wahyudi, 2024; Suciati, 2023).

The study of natural and social events in science produces products, processes, attitudes, and applications as the essence of science (Haryadi & Pujiastuti, 2019; Frigerio et al., 2021). This study is closely related to the local wisdom of a region (Hasbiah, 2015; Hidayati, 2019). In local wisdom there is knowledge, beliefs, understanding, or insight as well as customs or ethics that guide the behavior of people in a region (Naping et al., 2019).

One type of local wisdom in one of the regions that is down to earth and interesting to study is the Madura Bull Racing. The Madura bull racing has characteristics of specific types of cows, jockeys, banquets, and equipment (Ar Razy & Mahzuni, 2022; Yasir, 2023). In the Madura bull racing, there are material concepts related to natural life, society and the environment that can be studied in science and mathematics, such as work and energy, simple machines, mixed compound elements, and body regulation systems. The Madura bull racing as the local wisdom of Madura is full of social, historical, philosophical, mystical meanings as indigenous knowledge of the Madura people that can be studied scientifically to train students in literacy and numeracy, as well as understanding concepts.

Numerical literacy is a skill of using various basic mathematical concepts to solve various problems (Han et al., 2017; Putri et al., 2022; Siskawati et al., 2021). Numerical literacy is important for students to have because having numeracy literacy skills can make it easier for students to obtain and understand information as well as become a basic skill for learning a subject (Lindberg & Silvennoinen, 2017; Lubaidi et al., 2022; Manguni, 2022; Novita et al., 2022; Rohim et al., 2021).

However, in reality, according to the test results conducted by the Program of International Student Assessment (PISA) in 2018 in Indonesia, the literacy ability of Indonesian students earned 371 points and in the field of mathematics earned 379 points. These results explain that literacy and mathematics abilities students in Indonesia are still below the average score and are in the low category, which is ranked 74 out of 79 countries (OECD, 2019). The low numeracy literacy skills of students is also evidenced by the results of the Minimum Competency Assessment (MCA) in the 2022 public education report cards in the Bangkalan district at the state junior high school level, it was found that students' numeracy literacy skills were still below the minimum competency (Kemendikbudristek, 2022).

One of the subjects related to numeracy literacy skills is Natural Science (IPA) (Isa et al., 2023). In science subjects it is important to have a good understanding of concepts because several concepts in science subjects are related to each other, especially basic concepts (Situmorang & Sinaga, 2022). One of the basic concepts of science is related to the material motion and force. However, several previous studies stated that students' conceptual understanding of motion and force is still low (Arda & Anita, 2021; Kaniawati et al., 2019; Nasution et al., 2021; Sitepu & Yakob, 2019). The low understanding of students' concepts can be caused by abstract material that is difficult to understand.

The development of students' numeracy literacy and conceptual understanding can include the exploration of local knowledge that can be used in the context of science learning (Wei-Ting & Pat Shein, 2022). The use of local wisdom in science learning can make a concept more contextual because students can realize directly that the material they are learning is useful and relevant to everyday life (Dolo & Prodjosantoso, 2022; Lukman et al., 2019; Uge et al., 2019). One of the local wisdoms related to the material of motion and force is the bull racing (Siyati & Kamariyah, 2022; Suprapto et al., 2022). The bull racing can be used as a context for real examples of the application of motion and force material in everyday life because the concepts of force and motion are applied directly to the bull racing, such as the concept of the speed of the cow running, the distance and time the cow runs, the relationship between the mass of the cow rider with the speed of the cow when driving and so on (Siyati & Kamariyah, 2022).

Mathematics has a fairly important role in Natural Sciences because of the many uses of mathematical equations, numbers, symbols and symbols that are used as tools to understand Science concepts (J. Chen et al., 2021; Kapucu et al., 2016; Kiray et al., 2015; Nuhu & Abdullahi, 2022; Sen & Ay, 2017; Vinitsky-Pinsky & Galili, 2014). Several previous studies stated that local wisdom can be used as a science learning resource or as a science learning and teaching context (Yasir & Wulandari, 2020; Suprapto et al., 2022, Yasir et al., 2022; Nadifah et al., 2023), there is a relationship between numeracy literacy and science learning (Awang et al., 2021; Barnard-Brak et al., 2017; J. Chen et al., 2021; Y. Chen et al., 2020; Fidia et al., 2021; Jumriah, 2021), and there is still no research on socio-science learning in the context of the Madura cattle racing to find out the relationship between numeracy literacy skills and understanding the concepts of movement and force.

So far, according to several previous studies, they have only described how to teach socio-science in schools/fields in general and have not provided real examples by presenting certain local wisdom as a context for learning. Several methods commonly used in teaching socio-science in schools/fields include (1) discussion, (2) lecture, (3) observation, (4) literature review of various sources, (5) storytelling, (6) laboratory, (7) field-trips, (8) deductive and inductive, (9) dramatization, (10) question and answer (Jaganathan, 2023; Rajakumar, 2016; Rahmadani, et al., 2023). Discussion accompanied by lectures supported by observation and literature review has been described as a careful consideration of the relationships involved in the topic or problem being studied. Lectures followed by observation with a combination of discussion and literature review related to analysis, comparison, evaluation, and conclusion of the relationship between science and social life of society and material concepts. Discussion, lecture, observation and literature review are carried out to bring out student involvement in teaching based on natural phenomena of science and social society presented in the classroom aiming to stimulate mental activity, develop fluency and ease of expression, clarity of ideas in thinking, and training in presenting thoughts and facts (Addo et al., 2023).

Storytelling preceded by field trips to the field to be experimented in a laboratory whose results are generalized deductively-inductively and dramatization is one of the most important methods in teaching social science. Storytelling, field trips, laboratory, deductive-inductive and dramatization are arts that allow teachers to present local wisdom in the surrounding environment to students, through the medium of speech, a series of clear, lively, interesting and orderly events in such a way that their minds reconstruct these events, and they live in imagination through the experiences told so that teachers are very close to the hearts of students by attracting their attention (Guilarte et al., 2022). Various ways of teaching socio-science in schools/fields illustrate that students are trained to be literate, numeracy, and conceptually understand the concepts of the material being taught and also the local wisdom that is presented. Therefore, it is necessary to present examples of types of local wisdom in teaching socio-science in schools/fields such as Madura bull races to see students being able to be literate in numeracy and understand concepts.

The purpose of this study was to find the relationship between numeracy literacy skills and students' understanding of science concepts regarding the concept of motion and force in socio-science teaching in the context of Madura bull racing. This study is expected to enrich the literature review related to this topic and can be used by educators in improving the quality of learning.

METHODS

This type of research is descriptive quantitative. The research design is non-experimental with the correlational method. A non-experimental research design was used in this study because in this study the subjects did not receive any treatment. The correlational

method was chosen because the correlational method can explain whether or not there is a relationship between a variable and other variables (Sugiyono, 2019).

Figure 1. Relationship between variables

Information:
X = numeracy literacy skills
Y = concept understanding

The research population was class VII students of SMPN 1 Kamal totaling 288 students. Determination of the samples number using the Slovin formula with an error tolerance of 5%. The calculation for determining the samples number is contained in equation (1).

$$n = \frac{N}{1+N\,(e)^2} \qquad (1)$$

(Nalendra *et al*., 2021)

n = number of sampel
N = total population
e = fault tolerance limit

Based on the determination of the samples number using the Slovin formula, a minimum sample size of 168 students was obtained. In this study the samples number used was 188 students because it was determined based on class to make easier when collecting research data. The sampling technique in this research used simple random sampling. Simple random sampling technique is a random sampling technique without considering certain levels or categories in a population (Sugiyono, 2019). The simple random sampling technique was chosen because at SMPN 1 Kamal the class division of students was carried out randomly, not based on certain rankings or categories, so the population tended to be homogeneous.

The numeracy skills skills instrument consists of 10 questions with conventional multiple choice questions with 4 answer options and 1 correct answer, complex multiple choice with more than 1 correct answer option and true-false test questions. The instrument for the numeracy literacy skill test was adopted from Pusmenjar (2022) which was compiled by the Ministry of Education and Culture of the Indonesian Republic. The basic mathematical domains used in the numeracy literacy skills instrument include numbers, measurements and data. The context used in the numeracy literacy skills instrument includes personal and social related contexts. The categorization of numeracy literacy is listed in Table 1.

Table 1. Categorization of numerical literacy skills

Results	Category
$95 < L \leq 100$	Advanced
$80 < L \leq 95$	Proficient
$55 < L \leq 80$	Base
$0 \leq L \leq 55$	Need special intervention

(Martiyono et al., 2021)

The concept understanding instrument consists of 14 questions with the type of two tier multiple choice questions. The indicator for understanding the concept test sheet refers to the revised Bloom's taxonomy by Anderson & Krathwohl (2001). The categorization of numeracy literacy is listed in Table 2.

The instrument for understanding the concept test obtained an average validity value of 0.95 so that based on Aiken's V criteria it was very valid and the reliability percentage was 94% so based on Borich's analysis criteria it was very reliable.

Table 2. Categorization science conceptual understanding

Results	Category
$80 < P \leq 100$	Very high
$60 < P \leq 80$	High
$40 < P \leq 60$	Moderate
$20 < P \leq 40$	Low
$0 \leq P \leq 20$	Very low

(Alighiri et al., 2018)

The results of the research data were analyzed descriptively to determine the mean, maximum, minimum and standard deviation values. In the results of the research data, prerequisite tests were also carried out in the form of normality and linearity tests. The normality test in this study was carried out using the Kolmogorov-Smirnov method. The linearity test in this study used the Test for Linearity method. The hypothesis testing in this study used correlational analysis using Spearman's rank method and then analyzed the coefficient of determination. Calculation analysis of the coefficient of determination using the equation (2).

$$KD = (r^2) \times 100\% \quad (2)$$

(Pagiu & Pundissing, 2022)

KD = coefficient of determination
r = correlation coefficient

RESULTS AND DISCUSSION

Correlation data between numeracy literacy and conceptual understanding of the material on motion and force in Madura bull racing were obtained by conducting socio-science teaching. Socio-science teaching that was raised about Madura bull racing which became a general trend of local wisdom because it was easy for students to find to teach the concept of motion and force material. The integration of Madura bull racing in teaching the concept of motion and force material in socio-science teaching was carried out using observation-based learning design, discussion, field-trip, literature review, and dramatization demonstration by following the following activity steps.

INTRODUCTORY ACTIVITIES

Orientation

1. The teacher opens the learning activity by greeting and inviting students to be grateful and pray for the blessings that Allah has given.
2. The teacher checks student attendance.
3. The teacher relates the material/theme/learning activity that will be carried out with the students' experiences in the previous material/theme/activity about position and fulcrum.
4. The teacher provides motivation by inviting students to watch a video of the Madurese bull race.
5. The teacher asks trigger questions to arouse students' curiosity, such as:
   a. Do you know about the local wisdom of the Madurese bull race?
   b. What is the shape and form of the cow used in the bull race?
   c. What are the characteristics of cows and how to do the Madurese bull race?
   d. Why did you answer that way? What is the reason? Can you provide an explanation!
   e. In your opinion, can the local wisdom of the Madurese bull race be related to one of the science and numeracy literacy materials, as well as conceptual understanding?

CORE ACTIVITIES

Students are involved in proving answers by conducting observations and literature studies with students divided into several groups by the teacher. Students are invited by the teacher to conduct guided discussions, presentations, delivery and reinforcement of materials, and group assignments in the core activities below.

• Guided Discussion
1. The teacher invites students to identify the concept of science material in the local wisdom of Madurese bull racing.
2. The teacher asks students to identify the shape and form of the bull racing and the characteristics of the Madurese bull racing that distinguish it from other bull racing competitions.
3. Students review relevant literature to answer previously formulated questions.
4. The teacher asks students to analyze data and discuss with group members.
5. Students write down the results of a simple discussion by making illustrations on picture paper.

• Presentation
1. The teacher gives each group the opportunity to present the results of their discussion.
2. The teacher gives each group the opportunity to ask questions to the group that comes forward in turn

• Presentation and Reinforcement of Material
1. The teacher explains the material about the movement and force used in Madurese bull racing.
2. The teacher shows pictures or videos and performs a dramatization demonstration to support learning and invite students to be literate, numeracy, and understand the concept of movement and force contained therein.

• Group Assignments
1. The teacher gives students assignments to be worked on in groups.
2. The teacher asks students to compile the results of the previous class discussion in the form of illustrations/charts (the relationship between Madurese bull racing and one of the science materials, such as movement and force, and numeracy literacy, and understanding concepts).
3. The teacher asks students to present the results of the discussion and then conducts a question and answer session in front of the class based on the results obtained from the discussion activities carried out at the next meeting.
4. Verify the correctness of the results of student assignments by providing reinforcement of the material or reviewing student assignments by providing feedback on whether the material or concepts of science (motion and force) and numeracy literacy, as well as understanding of the concepts discussed are correct or not.

CLOSING ACTIVITIES
1. The teacher invites students to jointly make conclusions/summaries of the learning process and the results that have been discussed, such as "Madura bull racing has characteristics in ..."
2. Students are guided to make a follow-up plan from the results of observations and literature studies related to the movement and encouragement given when the cows are racing.
3. Students are asked to connect the science material/concept being studied with the next learning material.
4. The teacher explains information about the next learning and ends the learning activity by praying together

In this study, socio-science teaching was conducted in the context of Madura bull racing to find the relationship between numeracy literacy and conceptual understanding of the material on motion and force. Based on the results of the study, the highest value of numeracy literacy skills in socio-science teaching in the context of Madura bull racing was 94.12, which is included in the advanced category, while the lowest value of numeracy

literacy skills was 11.76, which is included in the category of needing special intervention. The average value of students' numeracy literacy skills was 49.62, which is included in the category of needing special intervention.

In the category of needing special intervention, it means that most students still have limited knowledge related to basic mathematics because the concepts mastered by students are not comprehensive and have limited arithmetic skills (Pusmendik, 2022). The overall average results show that students' numeracy literacy skills in socio-science teaching in the context of Madura bull racing are still in the category of needing special intervention. This is in accordance with the education report card in Bangkalan Regency at the 2022 State Junior High School level which shows that numeracy literacy skills are still below the minimum competency (Kemendikbudristek, 2022).

Meanwhile, the highest score for understanding science concepts in socio-science teaching in the context of Madura bull racing is 100, which is included in the very high category, while the lowest score for understanding concepts is 0, which is included in the very low category. The average score for science students' conceptual understanding of motion and force in socio-science teaching in the context of Madura bull racing is 39.06, which is included in the low category. Several previous studies have also stated that science students' conceptual understanding of motion and force is still relatively low (Nasution et al., 2021; Nurwahidah, 2021; Taqwa et al., 2020; Sitepu & Yakob, 2019). The results of the descriptive analysis are contained in Table 3.

Table 3. Descriptive Analysis Results

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Numeracy literacy	188	11.76	94.12	49.6244	16.27962
Conceptual understanding	188	.00	100.00	39.0578	21.33785
Valid N (listwise)	188				

Based on the results of the normality test, it is known that the data on both variables, namely numeracy literacy and conceptual understanding, are not normally distributed. This can be proven from the results of the significance of numeracy literacy skills of $0.000 \leq 0.05$ and the results of the significance of understanding concepts of $0.000 \leq 0.05$ so that the data on numeracy literacy skills and understanding of concepts is not normally distributed. The normality test results are contained in Table 4.

Table 4. Normality Test Results

One-Sample Kolmogorov-Smirnov Test			
		Numeracy literacy	Conceptual understanding
N		188	188
Normal Parameters[a,b]	Mean	49.6244	39.0578
	Std. Deviation	16.27962	21.33785
Most Extreme Differences	Absolute	.107	.107
	Positive	.089	.107
	Negative	-.107	-.055
Test Statistic		.107	.107
Asymp. Sig. (2-tailed)		.000[c]	.000[c]

The significance result for the deviation from linearity value is $0.628 > 0.05$ so it can be concluded that there is a linear relationship between the two variables, namely numeracy literacy skills and science conceptual understanding. The linearity test results are contained in Table 5.

Table 5. Linearity Test Results

ANOVA Table

		Sum of Squares	f	Mean Square	F	Sig.
Conceptual understanding* numeracy literacy	Deviation from Linearity	3416.452	3	262.804	.830	.628

Correlation analysis uses nonparametric statistics because the data is not normally distributed. Correlation analysis uses the Spearman rank method. The significance value obtained is 0.000 <0.05 so that it can be interpreted that in socio-science teaching in the context of Madura bull racing, a relationship was found between numeracy literacy skills and students' conceptual understanding of science about motion and force. The correlation coefficient value is 0.528 so that it can be interpreted that there is a positive relationship between numeracy literacy skills and conceptual understanding of science about motion and force in socio-science teaching in the context of Madura bull racing with a moderate relationship. The positive relationship between numeracy literacy skills and conceptual understanding in socio-science teaching in the context of Madura bull racing, then it can be interpreted that if students' numeracy literacy skills increase, then students' conceptual understanding of the material of motion and force in socio-science teaching in the context of Madura bull racing will also increase, and vice versa. This is in accordance with several relevant studies which also state that numeracy literacy skills are directly proportional to students' conceptual understanding in science subjects (Chen et al., 2021; Chen et al., 2020).

The results of the correlation analysis are in Table 6. The relationship between numeracy literacy skills and understanding of science concepts about motion and force in socio-science teaching in the context of Madura bull racing in medium strength classes is also supported by the scatter plot results in Figure 1. This is in accordance with several relevant studies which also state that numeracy literacy skills are directly proportional to students' conceptual understanding in science subjects (Awang et al., 2021; Y. Chen et al., 2020; Nyakyi & Mwenda, 2022). The relationship between numeracy literacy skills and understanding of science concepts is classified as moderate, supported by several similar studies, such as research related to the relationship between TIMSS mathematics test achievement and science learning achievement included in the moderate category (Wang, 2005). In addition, several studies related to the achievement of mathematics learning outcomes with science learning outcomes are also included in the moderate category (Kapucu et al., 2016; Nyakyi & Mwenda, 2022; Getenet & Getnet, 2023).

Table 6. Correlation Analysis Results

Correlations

			Numeracy literacy	Conceptual undertanding
Spearman's rho	Numeracy literacy	Correlation Coefficient	1.000	.528**
		Sig. (2-tailed)	.	.000
		N	188	188
	Conceptual understanding	Correlation Coefficient	.528**	1.000
		Sig. (2-tailed)	.000	.
		N	188	188

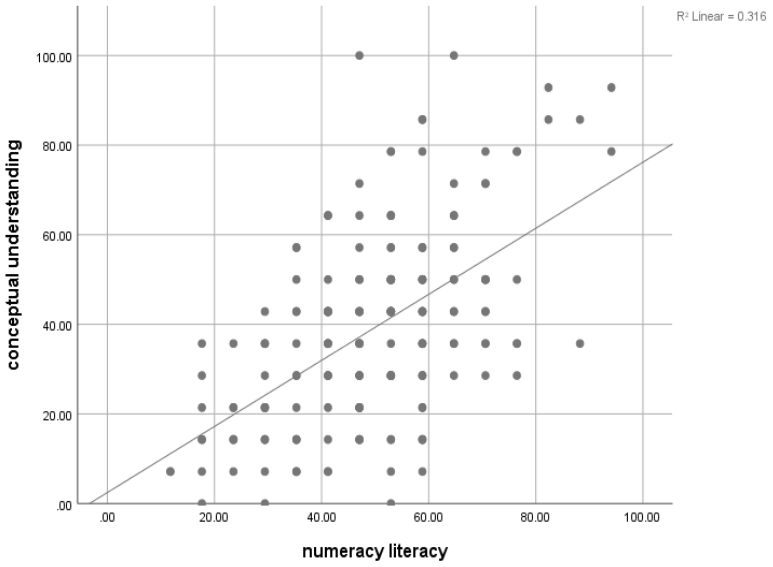

Figure 1. Scatter plot of findings on the relationship between numeracy literacy and understanding of science concepts in socio-science teaching in the Madura bull racing context

The finding of a positive relationship between numeracy literacy skills and conceptual understanding in socio-science teaching in the context of Madura bull racing is in accordance with one of the learning processes in Gagne's theory, namely the relationship between new information in the form of understanding the concept of motion and force in socio-science teaching in the context of Madura bull racing with information that is already owned in the form of numeracy literacy skills and in accordance with Gestalt theory which states that understanding is influenced by basic skills (Safitri et al., 2021; Simanjuntak, 2018). The results regarding the relationship between numeracy literacy skills and conceptual understanding in socio-science teaching in the context of Madura bull racing are moderately supported by several similar studies. Research on the relationship between TIMSS mathematics test achievement and science learning achievement is in the moderate category (Wang, 2005). In addition, several studies related to mathematics learning achievement and science learning achievement are also included in the moderate category (Kapucu et al., 2016; Nyakyi & Mwenda, 2022; Hasanah & Kusumawati, 2022).

The coefficient of determination is calculated using equation 2 so that the contribution of numeracy literacy skills to students' conceptual understanding of science about motion and force is 27.88%. Based on the coefficient of determination value, it can be concluded that 72.12% of students' conceptual understanding of science about motion and force in socio-science teaching in the context of Madura bull racing is influenced by other factors outside the variables of this study. This can be caused by several factors such as basic mathematics contained in the concept of motion and force in socio-science teaching in the context of Madura bull racing is only used as a tool to make quantitative predictions or to draw conclusions, while basic mathematics in numeracy literacy is more complex because there are several mathematical domains in it (Sanchez & Ponce, 2020). Another factor is that students' understanding of the concept of motion and force in socio-science teaching in the context of Madura bull racing not only requires basic mathematical skills, but also requires other abilities such as multi-representational skills, high-level thinking skills such as critical thinking skills and creative thinking skills, science process skills, problem-solving skills, metacognition, cognitive and learning styles (Kintoko et al., 2022; Noviantini et al., 2023; Nugraheni et al., 2023; Riskawati et al., 2021; Sahara et al., 2020; Yasir & Wulandari, 2020; Santiawati et al., 2022; Sari et al., 2018; Trihono, 2022; Yasir et al., 2022; David et al., 2020).

CONCLUSION

Based on the results of the study it can be seen that there is a positive relationship with a moderate relationship between numeracy literacy and students' understanding of the concept of motion and style in socio-science teaching in the Madura bull racing context. The conclusion of this study is that the correlation of numeracy skills on students' understanding of science concepts regarding motion and force in socio-science teaching in the Madura bull racing context racings is 27.88% and 72.12% is influenced by other factors. Suggestions that can be given are that in the learning process it is necessary to train other skills that support students to understand a concept optimally. This research has implications for improving science learning designs using the context of the local wisdom of the Madura bull racings in training and increasing understanding of science concepts and numeracy literacy skills.

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