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EDUCATION

INFLUENCE OF UTILIZATION OF IMPROVISED MATERIALS ON ACQUISITION OF NUMBER WORK SKILLS AMONG PRE-PRIMARY SCHOOL LEARNERS IN KIAMBU SUB-COUNTY, KIAMBU COUNTY, KENYA

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Abstract

Background Information: Use of instructional media resources plays an important role in enhancing learners' acquisition of number work skills. However, in Kiambu Sub-county, acquisition of number work skills by pre-primary school learners is low with many not able to solve basic mathematics problems.

Objective of the Study: The study sought to assess the influence of utilization of improvised materials on acquisition of number work skills among pre-primary school learners in Kiambu Sub-county, Kiambu County, Kenya. The study was guided by The Cognitive Theory of Multimedia Learning and Skills Acquisition Theory.

Research Methodology: The study adopted mixed methodology and thus, applied concurrent triangulation research design. Qualitative data were analyzed thematically along the objectives and presented in narrative forms. Quantitative data were analyzed descriptively using frequencies and percentages and inferentially using Pearson's Product Moment Correlation Analysis in Statistical Packages for Social Science (SPSS 23) and presented using tables.

Results and Findings: The study established that pre-primary school learners' number work skills are below average owing to inadequate use of improvised materials.

Conclusion and Recommendations: The study thus recommends that pre-primary school teachers should be made to understand that these are educational components which serve to enhance teaching concepts in number work. Pre-primary school teachers should be encouraged to adopt improvisation of number work materials. The Ministry of Education should enforce the usage of improvised materials to supplement supply of commercial teaching aids as a critical component of pedagogy in pre-primary schools.

Keywords: *Improvised materials, acquisition of number work skills, pre-primary school learners.*

1.1 INTRODUCTION

Education consists of two components and are classified as inputs and outputs. According to Cramer and Castle (2012), inputs consist of human and material resources and outputs are the goals and outcomes of the educational process. Cramer and Castle (2012) further posits that both the inputs and outputs form a dynamic organic whole and if one wants to investigate and assess the educational system in order to improve its performance, effects of one component on the other must be examined. Instructional media resources which are educational inputs are of vital importance to the teaching number work curriculum in pre-primary school education centers. These instructional media resources include use of improvised materials. Improvisation in number work skills is an element of creativity and resourcefulness. It is the use of local resources in our immediate environment to build, construct, mould or make instructional teaching-learning materials that can assist in the smooth dissemination and transfer of knowledge from teachers to learners.

In a study conducted in the Netherlands, Anyakoha (2013) indicated that improvisation in number work skills reveals that there are possibilities of alternatives to teaching and learning aids. It should therefore meet specific teaching and learning situation. Anyakoha (2013) further indicated that improvisation in number work skills is an act of designing a replica of standard equipment to play the role it is designated for. In other words, it is an act of using alternative resources to facilitate instructions for teaching wherever there is lack or specific first-hand teaching aids. It develops skills in the cognitive, affective and psychomotor domains and has become imperative in teaching and learning because the economic situation makes the cost of facilities and equipment very high amidst decreasing or near lack of purchasing power. Cognizant of these assertions, Conezio and French (2013) suggested that improvisation in number work skills is an answer to the problem associated with storage, repair, replacement, replenishment of consumable components of commercially available instructional materials and also a solution to the problem of intensive training of teachers and learners who will use the facilities and equipment.

In a study conducted in Nigeria, Dogara and Ahmadu (2013) revealed that the qualities of improvisation in number work skills- talents include creativities or resourcefulness and rich imagination that are transformable into realities. Dogara and Ahmadu (2013) indicated that local resources can be remolded and used to satisfy the quest for knowledge in the schools. These findings affirm the fact that improvisation of instructional materials is also the adoptive

ability of a resourceful teacher to produce facilities and equipment locally at low profile for teaching-learning processes. In the same vein, Horne (2013) also observed that in physical education and sports instructional domain, all types of equipment and supplies like the balls, apparatus, nets and standard implements will be needed for the conduct of individual and team sports as well as for other physical activities, considering the increase number of enrolment and also increase in the number of sport lovers, sport programmes use supplies and equipment that cost a lot of money. Such materials are vital to the health and safety of participants, to good playing condition and to values derived from the programme.

Given this situation, Higgins and Spitulnik (2013), in a study carried out in Tanzania, suggest that it is therefore, of paramount importance that alternative method of improvisation in number work skills must be used to see that physical education and sports programmes have the facilities, equipment and supplies necessary to conduct quality programmes. The improvised facilities and equipment must be well planned, carefully developed, made sufficient, and appropriately utilized to suit the sporting programme need at a particular period. Such methods as renovating existing plants, retrofitting and converting existing structures and instituting multiple uses of present facilities are methods that will in no small measure see to conduct of quality sporting programmes. In most pre-primary schools in Kenya, the phenomenon is similar with most of the factors on analytical work and improvisations in number work skills emphasize abilities.

In a study conducted in Kisumu East Sub-county, Burnett (2013) stated that improvisation in number work skills is an element of creativity. Burnett (2013) indicated that it is the use of local resources in our immediate environment to build, construct, mould, or make instructional teaching learning materials that can assist in the smooth dissemination and transfer of knowledge from teachers to learners. Burnett (2013) asserted that improvisation of culturally materials for instruction have made tremendous enhancement of lesson impact if intelligently used. Consistent with these assertions, Peterson (2014) observed that the utilization of improvised instructional number work materials takes adequate care of the three domains, that is, cognitive, affective and psychomotor thereby reducing the abstractness of the number work concepts for pre-primary school learners. Besides, when teachers improvise number work teaching and learning materials such as sound and heat producing, measurement, movement and construction, it enables pre-primary school learners to develop mental faculties or thoughts such as language, reasoning, thinking, imagination and problem solving. In Kiambu Sub-

county, many teachers do not have enough time to make supplementary resources, so they just follow the textbook (Mwaniki, 2009). However, a report by KNEC (2017) to monitor learner's achievement in literacy and numeracy had revealed that only 52% of pre-primary school learners were incompetent in solving mathematics problems. In the same token, a survey conducted by Uwezo (2010) had revealed that seven out of ten pupils in class three could do class two work. Uwezo (2010) further revealed that 60% of the pre-primary school learners in public pre-primary schools do not have the basic mathematical skills, while 34% of the pupils could not perform simple tasks that demonstrate numeracy skills. In the same token, a report from the County Government of Kiambu in the Department of Early Childhood Education reveals that 25.8% of the pre-primary school learners are not capable of solving basic mathematics' tasks. This is in line with the findings of studies have also revealed that the 19.8% of pre-primary school learners in Kiambu Sub-county do not possess the mathematical skills required to enter that grade (The Education Network in Kenya, 2011).

To mitigate these challenges, teachers have adopted use of improvised materials. The importance of utilizing improvised materials cannot be underestimated. Such media communicate information effectively, promote the acquisition and longer retention of knowledge, when they are systematically designed, reproduced, used and evaluated (Mwangi, 2012). However, the idea of improvisation which involves sourcing, selecting, creating, making, substituting, and providing local media and number work materials obtained within and outside the school environment in the absence of the original ones have not fully been embraced by most pre-primary school teachers, a factor that is likely to have contributed to learners lose interest and poor performance in number work subject in Kiambu Sub-county. Mwangi (2012) has not articulated how different improvised materials influence pre-primary school learners' acquisition of number work skills; hence the study.

1.2 STATEMENT OF THE PROBLEM

Early exposure and effective utilization of improvised materials prepares pre-primary school learners for number work skills since learners acquire knowledge through interaction with familiar materials within the environment. However, in Kiambu Sub-county, the situation is quite different with acquisition of number work skills by pre-primary school learners in Kiambu Sub-county being low. As stated in the background, a report by KNEC (2017) to monitor learner's achievement in literacy and numeracy had revealed that 52% of pre-primary school learners were incompetent in solving mathematics problems. In the same token, a survey

conducted by Uwezo (2010) revealed that 60% of the pre-primary school learners in public pre-primary schools do not have the basic mathematical skills, while 34% of the pupils could not perform simple tasks that demonstrate numeracy skills. Further, as noted earlier, a report from the County Government of Kiambu in the Department of Early Childhood Education reveals that 25.8% of the pre-primary school learners are not capable of solving basic mathematics' tasks. The Education Network in Kenya (2011) also pointed out that 19.8% of pre-primary school learners in Kiambu Sub-county do not possess the mathematical skills required to enter that grade. Despite these statistics, few empirical studies had interrogated the extent to which use of improvised materials influence acquisition of number work skills among pre-primary school learners.

Scope and Delimitations of the Study

This study was carried out among public pre-primary school schools in Ganze Sub-county. This study assessed the influence of child-headed family structures on socio-emotional development amongst pre-primary school learners. In this study, mixed methodology was applied and thus concurrent triangulation research design was adopted. Questionnaire was used to collect quantitative data from pre-primary school teachers, interviews were used to gather qualitative data from headteachers and parents' representatives whereas observation checklist was used to collect data from pre-primary school learners.

2.1 LITERATURE REVIEW

Theoretical Framework

The study was based on Cognitive Theory of Multimedia Learning by Mayer (2007), which is based on three main assumptions that, there are two separate channels for processing information (audio and visual), there is limited channel capacity; and that learning is an active process of filtering, selecting, organizing, and integrating information. The theory centres on the idea that, human memory has two sub-components that work in parallel (visual and verbal/acoustic) and that learning can be more successful if both of this can be used at the same time. It suggests that learners build meaningful connections between words and pictures and that, they learn more deeply than they could have with words or pictures alone. Words can be spoken or written and the pictures can be any form of graphical imagery including illustrations, photos, animation, real objects or video. The learner's job is to make sense of the presented materials as an active participant, ultimately constructing new knowledge.

To determine the most appropriate media for their needs, instructors must therefore evaluate the objectives, the content and the learner. Therefore, for acquisition of number work skills to take place, a variety of learning materials has to be provided for learners to interact with. This study was also guided by the Skill Acquisition Theory which was postulated by DeKeyser (2007b). The basic claim of skill acquisition theory is that the learning of a wide variety of skills shows a remarkable similarity in development from initial representation of knowledge through initial changes in behavior to eventual fluent, spontaneous, largely effortless, and highly skilled behavior, and that this set of phenomena came to be accounted for by a set of basic principles common to the acquisition of all skills. In this context, the scientific roots of skill acquisition theory can be found in different branches of psychology, which ranges from behaviorism to cognitivism and connectionism. It focuses on learning and acquisition of number work skills as a process of human learning. In this study number work skills acquisition is controlled by the use of instructional media resources. Thus, the rationale of using this theory in this study is that number work skills acquisition entails the utilization of declarative knowledge followed by procedural knowledge, with the latter's automatization. That is, conscious knowledge of facts, number work concepts or ideas that can be stored as propositions.

3.1 RESEARCH METHODOLOGY

The study adopted mixed methodology and thus, applied concurrent triangulation research design. The target population was 1207 respondents comprising 22 headteachers, 44 pre-primary school teachers and 1141 pre-primary school learners from which a sample of 300 respondents was calculated using Yamane's Formula. Stratified sampling was applied to create four strata based on the number of zones in Kiambu Sub-county. From each zone, four headteachers and 10 teachers were selected using purposive sampling. However, from each zone, 61 pre-primary school learners were selected using simple random sampling. This procedure enabled the researcher to sample 16 headteacher, 40 teachers and 244 pre-primary school learners. Qualitative data were analyzed thematically along the objectives and presented in narrative forms. Quantitative data were analyzed descriptively using frequencies and percentages and inferentially using Pearson's Product Moment Correlation Analysis in Statistical Packages for Social Science (SPSS 23) and presented using tables.

4.1 RESULTS AND DISCUSSIONS

The study sought to:

i. Assess levels of number work skills among pre-primary school learners in Kiambu Sub-county
ii. Examine the influence of utilization of improvised materials on acquisition of number work skills among pre-primary school learners in Kiambu Sub-county.

Response Rate

In this study, 44 questionnaires were administered to pre-primary school teachers out of which 36 questionnaires were filled and returned. At the same time, the researcher also interviewed 14 headteachers and conducted observation schedules among pre-primary school learners. This yielded response rates shown in Table 1.

Table 1: Response Rates

Respondents	Sampled Respondents	Those Who Participated	Achieved Return Rate (%)
Head teachers	16	14	87.5
Pre-primary School Teachers	40	36	90.0
Pre-primary School Learners	244	200	82.0
Total	**300**	**250**	**83.3**

Source: Field Data (2019)

Table 1 shows that headteachers, pre-primary school teachers and pre-primary school learners registered a response rate of 83.3%. This confirmed the findings of Creswell (2014) that a response rate above 75.0% is adequate and of suitable levels to allow for generalization of the outcomes to the target population.

4.3 Ratings of Pre-primary School Learners' Number Work Skills

The study sought to establish the ratings of pre-primary school learners' number work skills. This was measured in terms of manipulation skills, number recognition, number ordering, counting skills and performance of basic operations such as addition and subtraction. The results are shown in Table 2.

Table 2: Ratings of Pre-primary School Learners' Number Work Skills

Number Work Skills	Excellent	Very Good	Good	Fair	Below Average
	%	%	%	%	%
Manipulation	14.3	4.8	2.3	35.7	42.9
Number recognition	7.1	7.1	25.0	39.3	28.6
Number ordering	25.0	10.7	35.7	21.4	7.2%
Counting	14.3	14.3	28.6	32.1	10.7
Basic operation	10.7	5.0	2.2	25.0	57.1

Table 2 shows that 42.9% of the pre-primary school teachers indicated that manipulation skills manifested by pre-primary school learners are below average, 35.7% indicated fair, 14.3% indicated excellent, 4.8% indicated very good whereas a paltry 2.3% indicated that manipulation skills of pre-primary school learners are good. At the same time, 39.3% indicated that pre-primary school learners' number recognition skills are fair, 28.6% indicated below average, a quarter (25.0%) indicated good whereas 7.1% each indicated that number recognition skills are excellent and very good respectively. In the same vein, a fair proportion (35.7%) indicated that pre-primary school learners' number ordering skills are good, a quarter (25.0%) indicated excellent, 21.4% indicated fair, 10.7% indicated very good whereas a paltry 7.2% indicated that number ordering skills are below average. 32.1% of the pre-primary school teachers observed that pre-primary school learners' counting skills are fair, 28.6% indicated good, 14.3% indicated excellent as did those indicated very good whereas 10.7% indicated below average.

Furthermore, slightly more than half (57.1%) of the pre-primary school learners' performance of basic operation such as addition and subtraction are below average, a quarter (25.0%) indicated fair, 10.7% indicated excellent, 5.0% indicated very good whereas 2.2% indicated good. These findings corroborate the findings of a study conducted in San Diego in which Horne (2013) asserts that pre-primary school learners who have a broad base of experience in domain-specific knowledge such as number work move more rapidly in acquiring more complex skills. This is attributed to the fact that number work skills are privileged domains, that is, domains in which children have a natural proclivity to learn, experiment, and explore, they allow for nurturing and extending the boundaries of the learning in which children are already actively engaged. Thus, developing and extending children's interest is particularly important in the pre-primary school years, when attention and self-regulation are nascent abilities.

Improvised Materials and Acquisition of Number Work Skills among Pre-primary School Learners

The second objective of the study sought to assess the extent to which teachers' use of improvised materials influence acquisition of number work skills among pre-primary school learners. Descriptive data was collected from pre-primary school teachers, organized into specific thoughts and results are shown in Table 3;

Table 3: Views of Pre-primary School Teachers on the Influence of Improvised Materials on Pre-primary School Learners' Acquisition of Number Work Skills

Test Items	Ratings				
	SA %	A %	U %	D %	SD %
Teachers rarely improvise measurement resources such as strings while teaching to improve number work skills amongst pre-primary school learners	80.5	8.5	1.5	5.5	4.0
Teachers rarely improvise materials during teaching to improve number work skills among pre-primary school learners	78.5	14.5	2.5	3.0	1.5
Teachers use improvised number blocks to teach and improve number work skills amongst pre-primary school learners	69.5	12.0	2.0	10.0	6.5
Using improvised number shapes has improved number work skills amongst pre-primary school learners	70.0	10.5	3.5	9.0	7.0
Improvisation has not helped teachers to improve number work skills among pre-primary school learners	74.5	8.5	2.0	4.5	10.5

Table 3 shows that majority (80.5%) of the pre-primary school teachers strongly agreed with the view that teachers rarely improvise measurement resources such as strings while teaching to improve number work skills amongst pre-primary school learners as did 8.5% who agreed.

However, only 1.5% of the pre-primary school teachers were undecided, 5.5% of the pre-primary school teachers disagreed whereas 4.0% of the pre-primary school teachers strongly disagreed.

Table 3 further shows that 78.5% of the pre-primary school teachers strongly agreed with the view that teachers rarely improvise materials during teaching to improve number work skills among pre-primary school learners whereas 14.5% agreed. However, 2.5% were undecided, 3.0% disagreed whereas 1.5% strongly disagreed. These findings lend credence to the findings

of a study conducted in Nigeria in which Dogara and Ahmadu (2012) revealed that the qualities of improvisation in number work skills- talents include creativities or resourcefulness and rich imagination that are transformable into realities. Dogara and Ahmadu (2012) indicated that local resources can be remolded and used to satisfy the quest for knowledge in the schools. These findings affirm the fact that improvisation of instructional materials is also the adoptive ability of a resourceful teacher to produce facilities and equipment locally at low profile for teaching-learning processes.

Majority (69.5%) of the pre-primary school teachers strongly agreed with the view that teachers use improvised number blocks to teach and improve number work skills amongst pre-primary school learners while 12.0% agreed. However, 2.0% were undecided, 10.0% of the pre-primary school teachers disagreed whereas 6.5% strongly disagreed. Majority (70.0%) of the pre-primary school teachers strongly agreed with the view that using improvised number shapes has improved number work skills amongst pre-primary school learners while 10.5% agreed. However, 3.5% were undecided, 9.0% disagreed whereas 7.0% strongly disagreed. These findings are consistent with the assertions of Peterson (2014) that the utilization of improvised instructional number work materials take adequate care of the three domains, that is, Cognitive, Affective and Psychomotor thereby reducing the abstractness of the number work concepts such as heat production for pre-primary school learners.

These findings thus affirm the fact that when teachers improvise number work teaching and learning materials such as sound and heat producing, measurement, movement and construction, it enables pre-primary school learners to develop mental faculties such as language, reasoning, thinking, imagination and problem solving. These findings further corroborate the findings of a study conducted in Tanzania in which Higgins and Spitulnik (2013) indicated that it is paramount that alternative method of improvisation in number work skills must be used to see that physical education and sports programmes have the facilities, equipment and supplies necessary to conduct quality programmes. The improvised facilities and equipment must be well planned, carefully developed, made sufficient, and appropriately utilized to suit the sporting programme need at a particular period. This implies that use of local resources in the immediate environment to build, construct or mould or make instructional teaching learning materials that can assist in the smooth dissemination and transfer of knowledge from teachers to learners. In other words, improvisation of culturally materials for instruction have made tremendous enhancement of lesson impact if intelligently used. Besides,

utilizing improvised materials cannot be underestimated. Such media communicate information effectively, promote the acquisition and longer retention of knowledge, when they are systematically designed, reproduced, used and evaluated.

Inferential Findings on the Influence of Improvised Materials on Acquisition of Number Work Skills among Pre-primary School Learners

To verify the possibility of difference between use of improvised materials and learners' acquisition of number work skills, data were collected on how often pre-primary school teachers use improvised materials (very often =5, often = 4, sometimes = 3, rarely = 2 and never = 1) and learners' performance in number work skills. The results are shown in Table 4:

Table 4: Results on How Often Teachers Use Improvised Materials and Learners' Performance in Number Work Skills

Frequency of Teachers' Use of Improvised Materials	Performance of Pre-primary School Learners in Number Work Skills (%)
4	64
4	61
3	61
3	59
3	45
3	37
2	33
2	29
1	28
1	27
0	23
0	22
0	19
0	17

Source: Sample Number Work Achievement Test (2022)

Table 4 indicates that pre-primary school teachers who often improvise materials and use improved materials for teaching have their pre-primary school learners register better performance in number work skills.

These findings further corroborate the findings of a study conducted in Tanzania in which Higgins and Spitulnik (2013) suggested that it is therefore, of paramount importance that alternative method of improvisation in number work skills must be used to see that physical education and sports programmes have the facilities, equipment and supplies necessary to conduct quality programmes. These results were subjected to Pearson's Product Moment Correlation Analysis and results are shown in Table 5:

Table 5: Pearson's Product Moment Correlation Analysis Showing Relationship Between Frequency of Teachers' Use of Improvised Materials and Performance of Pre-primary School Learners in Number Work Skills

		Frequency of Teachers' Use of Improvised Materials	Performance of Pre-primary School Learners in Number Work Skills
Frequency of Teachers' Use of Improvised Materials	Pearson Correlation	1	.919**
	Sig. (2-tailed)		.000
	N	14	14
Performance of Pre-primary School Learners in Number Work Skills	Pearson Correlation	.919**	1
	Sig. (2-tailed)	.000	
	N	14	14

**. Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS Generated (2021)

Table 5 shows Pearson's Product-Moment Correlation Analysis which was run to determine the relationship between the frequency of teachers' use of improvised materials and performance of pre-primary school learners in number work skills. The test generated a correlation coefficient of r = 0.919 with corresponding significant level (p-value) of 0.000 which was less than the predetermined level of significance, 0.05, that is, p-value = 0.000<0.05. These findings further affirm the fact there is significant relationship between pre-primary school teachers' improvisation and pre-primary school learners' performance in number work skills. These results were consistent with the findings of a study conducted in Kisumu East Sub-county by Burnett (2013) which generated a p-value of 0.008 < 0.05. These findings thus affirm the fact that improvisation in number work skills is an element of creativity. That is, the use of local resources in our immediate environment to build, construct or mould or make instructional teaching learning materials that can assist in the smooth dissemination and transfer of knowledge from teachers to learners. This points to the fact that improvisation of culturally materials for instruction have made tremendous enhancement of lesson impact if intelligently used.

Thematic Analysis of Qualitative Findings on the Influence of Improvised Materials on Pre-primary School Learners' Acquisition of Number Work Skills

Headteachers were also interviewed and responded in favor of the view that pre-primary school teachers rarely improvise sound producing materials, e.g., strings, hollow sticks and clapping of palms, heat-producing materials, e.g. rubbing of dry sticks, palms or dry stones, movement materials, e.g. puppets and toys, ropes, rings and shakers and measurement materials, e.g. gourd, calabash, cup made of animal skin. The headteachers concurred with the views of Anyakoha (2013) that improvisation in number work skills is an act of designing a replica of standard equipment to play the role it is designated for. In other words, it is an act of using alternative resources to facilitate instructions for teaching wherever there is lack or specific first-hand teaching aids. Headteacher, H1, noted:

> "*Pre-primary school teachers rarely improvise sound-producing, heat-producing, movement and measurement materials to enhance number work skills such as manipulation, experimentation, observation, interpretation and Performance of basic operation such as addition and subtraction among Pre-primary school learners*".

From this verbatim, it is evident, just like in the quantitative findings, that improvisation of instructional materials is also the adoptive ability of a resourceful teacher to produce facilities and equipment locally at low profile for teaching-learning processes. It indicates that, when teachers improvise number work teaching and learning materials such as sound and heat producing, measurement, movement and construction, it enables pre-primary school learners to develop mental faculties such as language, reasoning, thinking, imagination and problem solving. Besides, utilizing improvised materials cannot be underestimated. Such media communicate information effectively, promote the acquisition and longer retention of knowledge, when they are systematically designed, reproduced, used and evaluated.

Summary of Research Findings

From the study findings, number work skills such as manipulation, experimentation, observation, interpretation and performance of basic operation like addition and subtraction are below average. Many pre-primary school teachers rarely improvise materials to help learners acquire number work skills. That is, there is little improvisation of sound producing materials, e.g., strings, hollow sticks and clapping of palms, heat-producing materials, e.g., rubbing of

dry sticks, palms or dry stones, movement materials, e.g., puppets and toys, ropes, rings and shakers, and measurement materials, e.g. gourd, calabash, cup made of animal skin.

5.1 RECOMMENDATIONS

The study recommends that pre-primary school teachers should be encouraged to adopt improvisation of number work materials. Pre-primary school teachers should vary the use of different graphic materials to breakdown monotony of learning by theory. The Ministry of Education should enforce the usage of media resources as a critical component of pedagogy in number work in public pre-primary schools.

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