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Exploring the Characteristics of Concrete Operational Stage among Primary School Students

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Abstract: *The purpose of the study was to explore the characteristics of the concrete operational stage among primary school students in Loralai. All the students studying in classes 3rd, 4th, 5th, and 6th at Government Girls High School Muhallah Kudezai comprise the population of the study. The total number of students was 223. Out of the total population, 187 students were randomly selected from the sampled school. An activity sheet based on six characteristics of Jean Piaget's cognitive development theory was constructed. The collected data were analyzed with the help of percentages. The findings of the study concluded that the students in Grades III, IV, V, and VI possess the characteristics of conservation, classification, transitivity, reversibility, seriation and decentration.*

Key Words: Concrete Operational Stage, Conservation, Classification, Seriation

Introduction

Background of the Study

An improvement in operational efficacy is a development. Cognitive refers to the ability to observe, comprehend, and conceive or just to know. It includes memory and thought processes. The process of learning, understanding, or comprehending is known as cognitive progress. Cognitive development is facilitated by maturity and environmental interaction (Papilla et al., 1990).

When developing the cognitive theory, Piaget made certain assumptions about children, such as the following: Three things that children learn naturally: 1) from their experiences, 2) on their own, and 3) without the assistance of others. Maturation, Experience, Social transmission, and Equilibrium are the four main components of cognitive growth (Huitt & Hummel, 2003). Piaget did studies on how young children acquire the capacity for logical and scientific cognition. According to Piaget, assimilation and accommodation are essential for effective learning. Accommodation is the process of fitting conceptions to new experiences, whereas assimilation is the process of moulding new experiences to fit preexisting ideas. Piaget's cognitive theory concentrates on both of these outcomes—short-term learning and long-term developmental change—which are produced by the two processes. According to Piaget, there are many stages in the evolution of cognition (Piaget, 1976). The stages bear numerous similarities to the developmental staircase paradigm. Every stage is completed in the same order, with none being skipped (Eggen & Kauchak, 2007). Every step transforms the level that came before it (Berk et al., 1997). The stage that comes after absorbs the stage that came before it. The objectives that kids are intended to accomplish during each stage of Piaget's stages are age-specific (Hetherington et al., 1999).

- Sensorimotor Stage: Birth to 2 Years
- Preoperational Stage: 2 to 7 Years
- Concrete Operational Stage: 7 to 11 years
- Formal Operational Stage: 11 and Beyond

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Sensorimotor Stage: Birth to 2 Years

They learn about the world by biting, touching, staring, and hearing things. These help children form their first conceptual understanding of objects (Donald, 2013).

The motor activity serves as a marker for this level in the absence of symbols. This stage of cognitive development is characterized by goal-directed behaviour, the concept of object permanence, mental representation, cause-and-effect linkages, and coordinated space.

Preoperational Stage: 2 to 7 Years

This stage of cognitive development is characterized by artificialism, animus, and transductive reasoning. Curiosity, seriation, irreversibility, centring, symbolism, and egocentrism.

Concrete Operational Stage: 7 To 11

At this age, kids start using logic (Miller et al., 2010).
This stage of cognitive development is characterized by logic, deduction, reversibility, cause-and-effect links, classification, transitivity, and the elimination of egocentrism (Piaget, 2001).

Formal Operational Stage: Age 11 and Beyond

According to Wilks et al. (2010), problem-solving, hypothetical thinking, abstract thinking, deductive reasoning, teenage egocentrism, imaginary audience, and personal feral are characteristics that characterize this stage of cognitive development.

Problem Statement

According to Hintermair (2020), "Cognitive development refers to the mind and how it works. It involves how children think, how they see their world, and how they use what they learn." Who children become has everything to do with the experiences they have early in their lives. Brains are built over time, and each experience affects growth and development. While genetics are important, the interplay between genes and experiences is the focus of research today. While the brain can be influenced at any age, it is the most pliable in the early years. Different stages of cognitive development were hypothesized by Jean Piaget. The current study was designed to explore the characteristics of the concrete operational stage among primary school students.

Objectives of the Study

1. To explore the characteristics of concrete operational stage among primary school students.
2. To examine the dominant characteristics of the concrete operational stage among primary school students.

Research Questions

1. What are the characteristics of the concrete operational stage among primary school students?
2. What are the dominant characteristics of concrete operational stage among primary school students?

Significance of Research

The study will be beneficial for all the stakeholders who belong to the teaching-learning process.

Delimitation of the Study

The study was delimited to the students of public sector primary schools at Loralai.

Review of Related Literature

One of the most well-known hypotheses about children's cognitive development from the previous century was put forth by Jean Piaget. Piaget suggested that children go through four phases of cognitive development: sensorimotor, preoperational, concrete operational, and formal operational. Although

Piaget's theories have had a significant impact on developmental psychology, there have been disagreements about their acceptance. A few issues with Piaget's hypothesis include the underestimation of baby ability and the overestimation of teenage aptitude. Piaget also disregarded the ways in which social and cultural contexts influenced children's cognitive and thinking development. Piaget also conducted research on his own children, which was a methodological error that created ethical and biased questions about his theory. However, Piaget's contributions—especially with regard to children's educational processes and the integration of cognition into psychology—remain crucial, and the field of child development has greatly benefited from them (Babakr et al., 2019).

Cognitive development is a crucial aspect of human development and one of Jean Piaget's main research areas. As per his theoretical framework, children undergo multiple discrete stages in the progression of their cognitive capacities, hence transforming their cognitive processes and worldviews (Marwaha et al., 2017).

Acquiring the capacity to observe, know, or understand is known as cognitive development. Piaget conducted research on the development of young children's aptitude for scientific and logical thought. Assimilation and accommodation are necessary for learning to occur effectively, according to Piaget. Regardless of their environment, children have an inbuilt need to learn and acquire knowledge through experiences, according to Piaget's theory. According to Piaget, the development of cognition occurs in distinct phases that go in a predetermined order. Piaget identified four stages: the Sensorimotor stage, lasting from birth to two years; the Preoperational stage, lasting from two to seven years; the Concrete operational stage, lasting from seven to eleven years; and the Formal operational stage, lasting from eleven years and beyond. Goal-directed behaviour, object persistence, mental representation, cause-and-effect relationships, goal-directed action, and coordinated spaces are characteristics of the sensorimotor stage of cognitive development. There are six further levels within the sensorimotor level. Each step below is linked to the development of more advanced skills. Transductive thinking, animism, artificialism, egocentrism, symbolic functioning, centration, irreversibility, curiosity, and seriation are traits of preoperational cognitive development. Imitation, symbolic play, painting, mental imaging, and vocal evocation of events are examples of preoperational stage behaviours. Logical reasoning, decentration, reversibility, cause-and-effect relationships, classification, transitivity, and the eradication of egocentrism are traits of cognitive development at the concrete operational level. Abstract thinking, logical reasoning, problem-solving, hypothetical thinking, teenage egocentrism, imaginary audience, and personal tales are among the characteristics that are present at the formal operational stage of cognitive development. Three fundamental ideas form the basis of Piaget's cognitive theory: stages, schemas, and adaptations (McLeod, 2018)

Ghazi and Ullah (2015) studied how the concrete operational stage affected the academic achievement of math students in both rural and urban areas. The results of the study showed that children can use logic in both urban and rural settings, and they can also display some understanding of number conservation, ordering, and reversibility.

According to Piaget's premise, the capacity for logical reasoning develops along with intelligence. Operational behaviours like segregation and classification have their roots in previous actions involving children between the ages of seven and eleven. Because seriation and classification are essential to language syntax and semantics, a child's reading proficiency may suffer specifically if these skills are not fully operationalized. Then, the science curriculum might help to promote the cognitive development required for successful reading. The report's conclusion contains suggestions for altering the scientific curriculum.

According to Piaget (1976), the theory attempts to explain various facets and components of the process of human cognitive development. This concept implies what children can be taught or exposed to. They also provide recommendations for the topic matter and format of the classes. The main tenet of this ideology is that if a kid has not yet attained a certain developmental stage, they should not be taught or exposed to subjects. People learn different subjects based on their brain capacities at a particular developmental period. Any attempt to teach a youngster something they are not intellectually ready for will cause them to become upset and suffer from mental impairment. From birth through adolescence and

into maturity, cognitive development includes the growth of intellectual processes, such as remembering, solving problems, and making decisions. Play has several advantages for the growth of the brain. It fosters the development of children's imagination and memory, two skills crucial for thinking about the past, present, and future (John, 2008).

According to Ahmad et al. (2016), play is a vital source of enhancing children's cognitive development. The study's findings concluded that students are inherently curious and enjoy using play to explore new ideas.

Two other logical processes that emerged at this time are classification and seriation (Piaget, 1976), both of which are essential for understanding ideas related to numbers. The ability to organize objects according to their length, weight, or volume in an ascending or descending order is known as seriation. However, classification entails putting items in groups according to a shared trait. According to Burns & Silbey (2000) (p. 55), "Hands-on experiences and multiple ways of representing a mathematical solution can be ways of fostering the development of this cognitive stage."

Ringleb and Wilbert (2018) study how different mental operations (strategies) interact to affect how well concrete-operational notions are resolved. The findings have the potential to enhance educational programs and provide an understanding of the complex cognitive processes associated with performing concrete operational tasks.

In Piaget's Theory of Cognitive Development, the Concrete Operational Stage is the third stage. The span of ages is seven to eleven. At this age, the child starts to acquire the skills of operational reasoning. Children are capable of learning how to sort understand cause-and-effect relationships, and do well in math and science. It was found that there are substantial differences in children's cognitive development between rural and urban areas on a real operational level. Gender differences are completely irrelevant to the development of cognition. Students' cognitive capacities also vary within the same fields. The conclusion of the work contains scholarly recommendations (Talat et al., 2013).

Using Piaget's theory of cognitive development, the study compared the scholastic performance of urban and rural students in general science using the Concrete Operational Stage. The study's conclusions showed that most children who are at the concrete operational stage of Piaget's theory possess the abilities needed to deal with difficulties in both rural and urban environments, as well as in general scientific education, to some extent. Nonetheless, when it comes to aptitude and the capacity to answer general science questions on Physics, Chemistry, and Biology, urban schoolchildren do better than their rural counterparts in Piaget's concrete operational stage. In conclusion, Piaget's concrete operational stage pupils' general scientific learning is influenced by the sociocultural situation (rural vs. urban) (Ghazi & Ullah, 2015).

The results show that while children's websites are not well structured to develop seriation (ordering) and reversibility, they are reasonably effective in improving children's classification and conservation skills. It is clear that these kinds of technologies are ill-suited to give kids between the ages of 7 and 11 a chance to grow cognitively (Prirokh & Nadri, 2011).

The purpose of this research is to investigate Piaget's cognitive hypothesis of young children's preparedness for primary school entry. The study's findings were analyzed by statistical computations. According to the results, the instruments designed were sufficient in measuring early childhood students' cognitive preparedness for entrance exams to elementary schools. Furthermore, the typical tested child is pretty prepared, but he needs the teacher's assistance to ensure that his cognitive abilities develop to their full potential (Kholiq, 2020).

Research Methodology

The present study was descriptive in nature, in which the researcher collected data concerning the current status of the subject of the study. All the students studying in class 3rd, class 4th, class 5th and class 6th in Government Girls High School Muhallah Kudezai comprise a population of the study. The number of students was 223. Out of the total population, 187 students were randomly selected from Government Girls High School Muhallah Kudezai. An activity sheet based on six characteristics of Jean Piaget's Cognitive

development theory was constructed with the help of a supervisor in relation to the objectives of the study. The researcher personally visited the sampled school for data collection and conducted the activity in the presence of a class teacher. The collected data was analyzed by using the percentage as a statistical tool.

Analysis of Data

Table 1

Students' ability to conservation

Classes	Yes		No	
	Frequency	Percentage	Frequency	Percentage
Grade III	35	64.81	19	35.18
Grade IV	58	100	0	0
Grade V	22	66.66	11	33.33
Grade VI	42	100	0	0

Graphical Representation of Table 1

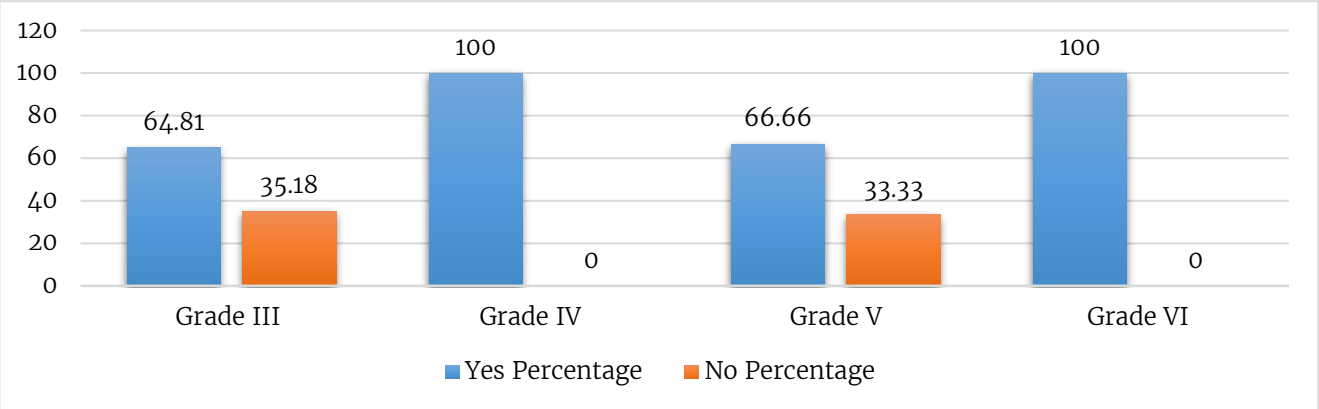

Table 1 describes how 64.81% of students of Grade III have the ability to conservation. 100% of Grade IV students have conservation abilities. 66.66% of students in Grade V have conservation abilities, and 100% of students in Grade VI have conservation abilities.

Table 2

Students' ability of reversibility

Classes	Yes		No	
	Frequency	Percentage	Frequency	Percentage
Grade III	38	70.37	16	29.62
Grade IV	58	100	0	0
Grade V	33	100	0	0
Grade VI	42	100	0	0

Graphical Representation of Table 2

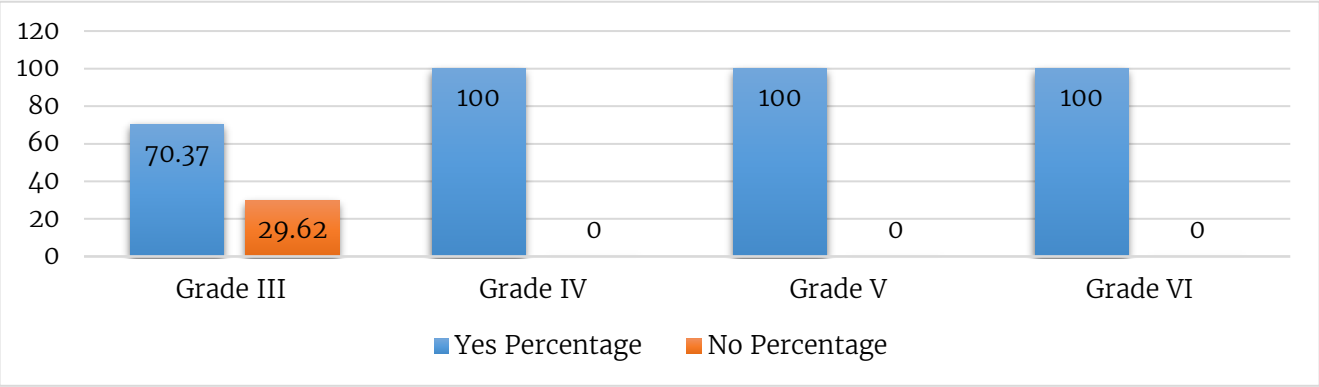

Table 2 describes 70.37% of Grade III students who have the ability to reverse. 100% of Grade IV students have the ability to reverse. 100% of students of Grade V have the ability to reverse, and 100% of students of Grade VI have the ability to reverse.

Table 3

Students' ability of classification

Class	Yes		No	
	Frequency	Percentage	Frequency	Percentage
Grade III	54	100	0	0
Grade IV	46	79.31	12	20.68
Grade V	31	93.93	2	6.06
Grade VI	42	100	0	0

Graphical Representation of Table 3

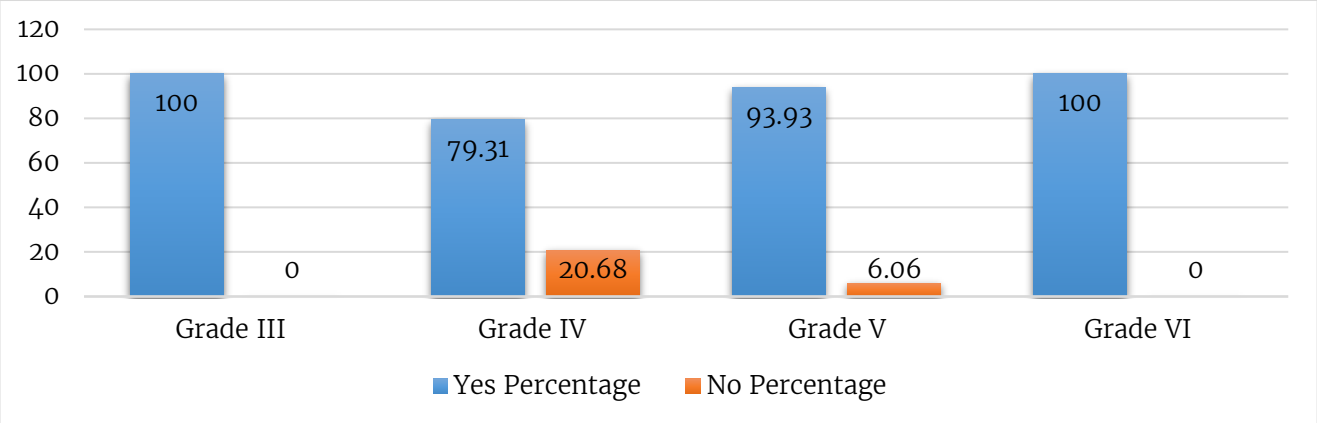

Table 3 describes how 100% of students in Grade III have the ability to classification. 79.31% of students in Grade IV have the ability to classify. 93.93% of students in Grade V have the ability to classify, and 100% of students in Grade VI have the ability to classify.

Table 4

Students' ability to transitivity

Classes	Yes		No	
	Frequency	Percentage	Frequency	Percentage
Grade III	22	40.74	32	59.25
Grade IV	33	56.89	25	43.10
Grade V	18	54.54	15	45.45
Grade VI	20	47.61	22	52.38

Graphical Representation of Table 4

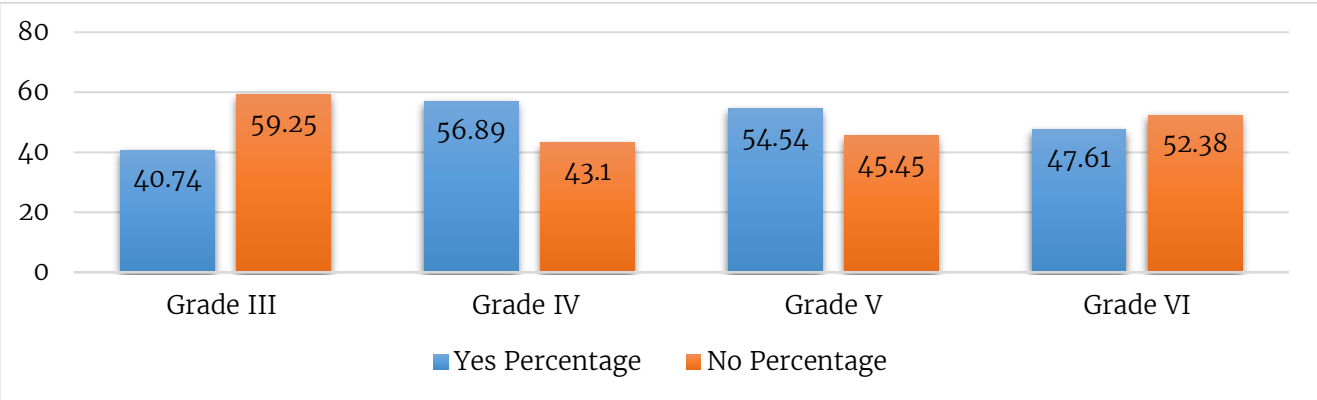

Table 4 describes that 59.25% of students in Grade III have no ability to transition. 56.89% of students of Grade IV have the ability to transit, and 54.54% of students of Grade V have the ability to transit. 52.38% of students in Grade VI have no ability to transition.

Table 5

Students' ability to seriation

Classes	Yes		No	
	Frequency	Percentage	Frequency	Percentage
Grade III	41	75.92	13	24.07
Grade IV	58	100	0	0
Grade V	33	100	0	0
Grade VI	42	100	0	0

Graphical Representation of Table 5

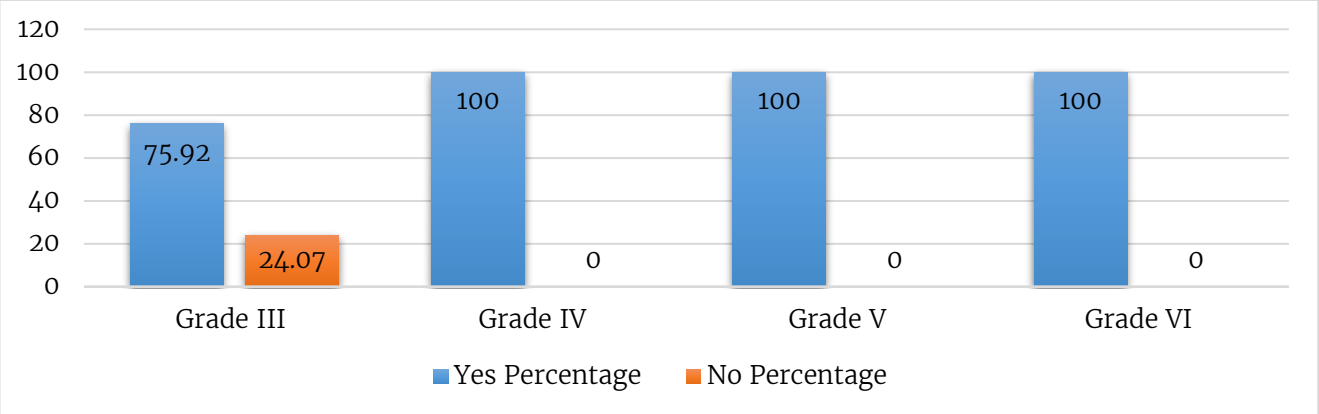

Table 5 describes 75.92% of students of Grade III who have seriation ability. 100% of Grade IV students have seriation ability. 100% of students of Grade V have seriation ability, and 100% of students of Grade VI have seriation ability.

Table 6

Students' ability to Decentration

Classes	Yes		No	
	Frequency	Percentage	Frequency	Percentage
Grade III	48	88.88	6	11.11
Grade IV	58	100	0	0
Grade V	33	100	0	0
Grade VI	42	100	0	0

Graphical Representation of Table 6

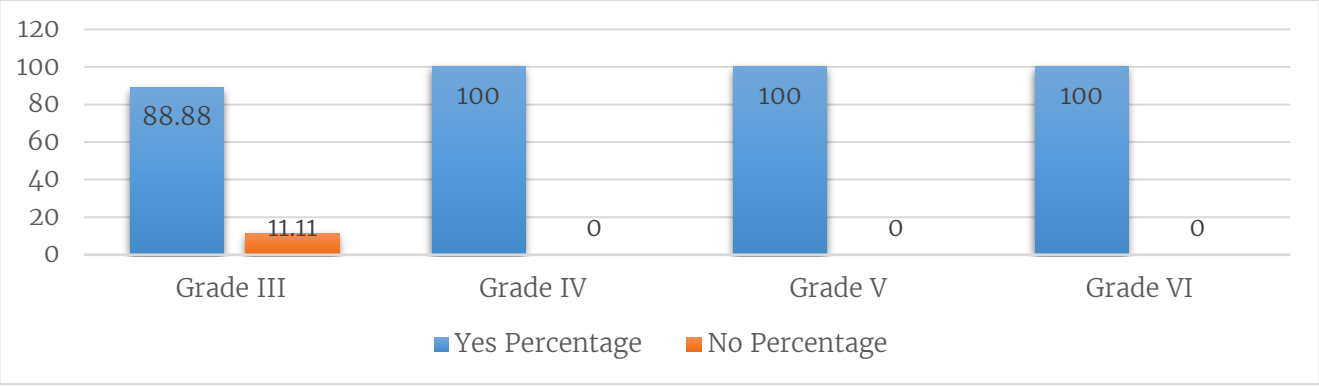

Table 6 describes that 88.88% of students of Grade III have the ability to decentrate. 100% of students of Grade IV have the ability to decentrate. 100% of students of Grade V have the ability to decentrate, and 100% of students of Grade VI have the ability to decentrate.

Findings

1. Table 1 describes how 64.81% of students of Grade III have the ability to conservation. 100% of Grade IV students have conservation abilities. 66.66% of students in Grade V have conservation abilities, and 100% of students in Grade VI have conservation abilities.
2. Table 2 describes 70.37% of students of Grade III who have the ability to reverse. 100% of Grade IV students have the ability to reverse. 100% of students of Grade V have the ability to reverse, and 100% of students of Grade VI have the ability to reverse.
3. Table 3 describes how 100% of students in Grade III have the ability to classify. 79.31% of students in Grade IV have the ability to classify. 93.93% of students in Grade V have the ability to classify, and 100% of students in Grade VI have the ability to classify.
4. Table 4 shows that 59.25% of Grade III students have no ability to transit. 56.89% of students of Grade IV have the ability to transit, and 54.54% of students of Grade V have the ability to transit. 52.38% of students in Grade VI have no ability to transition.
5. Table 5 describes how 75.92% of students of Grade III have seriation ability. 100% of Grade IV students have seriation ability. 100% of students of Grade V have seriation ability, and 100% of students of Grade VI have seriation ability.
6. Table 6 describes that 88.88% of students of Grade III have the ability to degrade.100% of students of Grade IV have the ability to decentrate. 100% of students of Grade V have the ability to decentrate, and 100% of students of Grade VI have the ability to decentrate.

Conclusion

The majority of Grade III students have the ability to conserve. Most students in Grade IV have the ability to conserve. A maximum number of students of Grade V have conservation ability, and all students of Grade VI have conservation ability.

Most students in Grade III have the ability to reverse. All the students of Grade IV have the ability of reversibility. All the students of Grade V have the ability of reversibility, and all the respondents of Grade VI have the ability of reversibility.

All the students of Grade III have the ability to classify. The majority of participants in Grade IV have the ability to classify. Most students of Grade V have the ability to classify, and all students of Grade VI have the ability to classify.

A maximum number of students in grade III have no ability to transition. Most students of Grade IV have the ability of transitivity. Most students in Grade V have the ability to be transitive. Half of the students of Grade VI have no ability to transition.

Most students in Grade III have the ability to seriate. All students of Grade IV have the ability to seriate. All students of Grade V have the ability of seriation and all students of Grad VI has the ability of seriation.

A maximum number of Grade III participants have the ability to decentrate. All students of Grade IV have the ability to decentrate. All the respondents of Grade V have the ability of decentration, and all the of Grade VI have the ability of decentration.

Recommendations

Based on the findings, the following recommendations were made.

1. The curriculum developer may develop a curriculum in accordance with the intellectual level of the students.
2. Activities related to the concrete operational stage might be included in the textbook.
3. The teacher might be trained to identify the characteristics of the concrete operational stage of the students.

4. Teachers may use various teaching methods to enhance student's abilities related to the concrete operational stage.

Recommendations for Future Research

1. A similar study might be replicated at private sector schools.
2. A comparative study might be conducted to analyse concrete operational stage characteristics among male and female students.

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