SOME MISCONCEPTIONS OF PROSPECTIVE TEACHERS ABOUT SCIENCE

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ABSTRACT

World is changing from agro-based to industrial to technology-driven society very speedily, yet the teaching –learning of science is not retaining the popularity as it used to have in past. One of the detrimental factors in this scenario is the way science is being taught in primary schools. The nitty-gritties of how to teach a science concept to primary students is in purview of science education being offered in universities' degree programs. What they have or have not understood properly while learning science in primary schools was a matter of worry as observed while teaching science groups in B. Ed. degree program at one college of Education in Fiji. This basic observation stimulated the authors to find out if these student teachers have learned the basic science concepts at the time of their primary schooling correctly or what. The research revealed the misconceptions in their answers. These misconceptions were categorized as nonscientific belief (NB) or conceptual misunderstanding (CM), factual misconception (FM) or Confusion with other scientific terms (CS) with different frequencies. These findings can inform colleges of Education to pay attention to it before the student teachers are offered a degree program or Science Education program.

Key words: *Science Education, conception, misconception, conceptual change, conceptual learning, primary students*

INTRODUCTION

Knowledge keeps on changing with the advent of new, research-based information. A lot of people might not know that their ideas or concepts may be incorrect, incomplete or imperfect. It might be difficult for them to accept that their ideas or concepts were wrong, since they carried those misconceptions for quite a long time. People grow in terms of their knowledge on these conceptions (or misconceptions), which may have a serious impact on their future learning, especially learning the complex concepts. When we try to understand the information, misconceptions can occur. This is because when we receive new information, we use our brains to process it, either by making certain patterns or by seeking certain patterns. Julia Gooding and Bill Metz in an article of Wesson (2001, p. 61) explains, "When information arrives in the cerebral cortex for analysis, the brain attempts to match each component with previously stored memory elements on the existing neural network with similar traits." New information is connected to existing one. If it does not fit learner's pattern of thinking, it is refashioned to make it fit with the existing fashion. This is when misconceptions are likely to create. The learners build their own explanation, unfold problem and file new data on faulty reasoning. If the misconception stays for a longer time, then it may become embedded in the brain. Some of these misconceptions get transferred from society-from parents, friends, and teachers. Some of them come through faulty text books. In most of the cases the information learnt wrongly is difficult to be

edited or deleted. Despite the best efforts made by teachers, students do not understand in right perspective, basic or fundamental concepts taught in class. This makes the teachers surprise to learn that students do not grasp fundamental ideas covered in class despite their best efforts. Some of the best students give the right answers but are possibly using correctly memorized words, which is still okay.

Definition of key concepts

Science Education: The process of teaching and learning of science to students. Wikipedia defines it: *Science education* is the *teaching* and *learning* of *science* to non-scientists, such as *school* children, college students, or adults within the general public. The field of *science education* includes work in *science* content, *science* process (the *scientific* method), some social *science*, and some *teaching* pedagogy.

Conception: Abstract ideas or notions that occur in brain. Wikipedia defines it as: mental representations, where concepts are entities that exist in the mind (mental objects), or-Concepts as abilities, where concepts are abilities peculiar to cognitive agents (mental states).

Misconception: are commonly held beliefs about scientific concepts that are not based on actual scientific fact. They are insufficient understandings about a concept. Scientific misconception refers to preconceived notions based on religious and/or cultural influences. Dictionary.com defines it as- an erroneous conception; mistaken notion.

Conceptual change: Wikipedia defines it in this way- the process whereby concepts and relationships between them change over the course of an individual person's lifetime or over the course of history.

Conceptual learning: According to Wikipedia-conceptual learning - known as Concept learning, also known as category learning, concept attainment, and concept formation, is defined by Bruner, Goodnow, & Austin (1967) as "the search for and listing of attributes that can be used to distinguish exemplars from non exemplars of various categories". More simply put, concepts are the mental categories that help us classify objects, events, or ideas, building on the understanding that each object, event, or idea has a set of common relevant features. Thus, concept learning is a strategy which requires a learner to compare and contrast groups or categories that contain concept-relevant features with groups or categories that do not contain concept-relevant features.

Primary students: These are the students learning in elementary schools, where main focus is on reading, writing, speaking and rhetoric.

RATIONALE

In one of the trimesters when unit on Science Education was offered to B.Ed. – Primary student teachers, the researcher observed that quite a good number of student teachers have written wrong explanation / definition for some of the most commonly used concepts. Should these wrong explanations be treated as, "mistakes" or errors, "misconceptions" or misleading ideas, and "misunderstandings" or misinterpretations of facts? Are these developed due to wrong association of concepts, or out of confusion with similarly pronounced words? Quoted by Blosser, Patricia E, Fisher contends that misconceptions serve the needs of the persons who hold them and that erroneous ideas may come from strong word association, confusion, conflict, or lack of knowledge (1985)." Out of interest, the researchers decided to get answers to some of these questions by analyzing further, student teachers' exam papers and to find out reality about conceptions/ misconceptions about the concepts asked in exam paper.

REVIEW OF LITERATURE

Literature is full of researches done on study of misconceptions. Some researchers have classified them on the basis of the pre-conceived notions, nonscientific beliefs, conceptual misunderstandings, vernacular misconceptions, factual misconceptions as suggested in http://www.nap.edu/read/5287/chapter/5

The categories used in this paper are on the guidelines of these, however vernacular misconceptions was not considered, as the native Fijians' local language-I taukei is not an official language used in teaching-learning process.

OBJECTIVES

The intention of this study was to study the conceptions and misconceptions that the prospective primary teachers have about science-related concepts and phenomena of daily usage. For this study following objectives were focused-

- To identify the misconceptions about Biology-related concepts asked in exam paper
- To categorize these misconcepts according to explanation provided by learners

METHODOLOGY

Research methodology used in this study was an exploratory survey method.

POPULATION

More than 250 student teachers doing B. Ed –primary program were enrolled in the unit on Science Education from different campuses of FNU. Of these about 150 student teachers were enrolled in the unit on Science Education from one campus of the university.

SAMPLE

Out of these 150, 65 student teachers from two tutoring groups with the researcher were selected for study for ease of accessibility, cost-effectiveness and time effectiveness. The sample was thus purposive in nature.

TOOL USED

Observations on Final exam paper for the end of trimester exam were used as a tool to study and identify prospective teachers' misconceptions. The exam paper had three sections- section A-related to concept definition and comparison, Section B- questions in the form of paragraph writing and Section C-had essay questions. The paper setter also prepared scoring key to keep similarity in valuation of all papers across all campuses of FNU. The researchers were interested in definition of concepts to check the student teachers' understanding (and misunderstanding). Therefore this section was focused. This section had 14 pairs of words that represented 9 pairs of science-related and 5 pairs of Education-related concepts. The science – related concepts were supposed to have been learnt and consolidated by the prospective teachers, when they themselves attended primary schools, whereas, the Education – related terms were supposed to have been learnt by them through year one-Education units. Of these only seven pairs of Biology-related concepts were looked into for this study regarding student teachers' understanding. These pairs of concepts were as listed below-

1- Breathing and Respiration
2- Food chain and Food web
3- Ingestion and Egestion
4- Insects and Arachnids
5- Pollination and Fertilization
6- Physical breakdown and Chemical breakdown
7- Vertebrates and Invertebrates
8- Heat and Temperature (Non-Biology-related and answered correctly)
9- Evaporation and boiling (Non-Biology-related and answered correctly)

10- Dependent variable and independent variable
11- Open-ended question and Close-ended question
12- Observation and Inference
13- Learning with understanding and learning without understanding
14- Phenomenological and vocabulary-based misconception

From the above list the concepts related to physics-viz. heat and temperature and Evaporation and boiling were removed from this study since all of them wrote correct answers to them. Five pairs of terms were related to Education Foundation. They were also unfocused and only Biology-related seven pairs of concepts were focused from the above list.

The information collected was analyzed using scoring key and presented in the form of various tables. It was observed that some of the concepts definitions in scoring key were inadequate, incomplete or imperfect, for the reasons best known to the paper setter. In such instances, technically correct definition/explanation was given in the beginning of each table categorizing student teachers' responses.

STATISTICAL TECHNIQUE

The data collected was processed mainly for qualitative analysis and quantitatively for simple percentages of types of misconceptions, after categorizing them, as presented in tables below.

PROCEDURE

The exam paper at the end of term final exam had Section A-related to concept definition and comparison, Section B- questions in the form of paragraph writing and Section C-had essay questions. The researchers were interested in definition of concepts to check the student teachers' understanding (and misunderstanding) and for further analysis of misconceptions.

Explanations given for each of these concepts were differently worded by different examinees, but pointing to the same / similar meanings. However, they were recorded in essence in each category as indicated in the following tables- Table No 1 through Table No. 7 showing student teachers' answers on pairs of scientific concepts.

DATA PRESENTATION

Table 1: Breathing and Respiration—Breathing is first step in respiration, also known as external respiration, followed by internal respiration and then followed by tissue respiration. Breathing is -Taking air into lungs & expelling it from lungs. Respiration is Process involving production of energy with intake of O_2 & release of CO_2 from oxidation of complex organic substances at cellular level.

Correct answer Breathing	Partially correct answer	Non-Scientific Belief	Confused Misconception	Confusion with other scientific term	Factual Misconception	No answer
Taking air into lungs & expelling it from lungs	Inhaling o2 & exhaling air			Inhaling for yourself, normal breathing without support -**artificial breathing**	Taking in O2 & exhaling CO2, taking in air through nose, taking air in & out of body,	03

Correct answer Respiration	Partially correct answer	Non-Scientific Belief	Confused Misconception	Confusion with other scientific term	Factual Misconception	No answer
Process involving production of energy with intake of O2 & release of CO2 from oxidation of complex organic substances	O2 is used to breakdown of energy, exchange of gases – O2 & CO2, process of energy release	sweating after breathing	Process of taking in & out water, taking in & out minerals	**Circulation**-moving air in all body parts, **Perspiration**-Body losing water through sweating,	Breakdown of energy resulting in sweating, sharing of air to another person, Need of breathing with another person's assistance	02

Table 2-Food chain and Food web-food chain –prey-predator relationship, A linear network of links in a food web starting from producers such as grass or trees using solar radiation to make food and ending with apex predators like whales or bears. **Food web is-** A network of food chains or feeding relationships by which energy & nutrients are passed down from one species to another concept is not understood due to confusion in food chain, which is evident from large no.(17) of respondents.

Correct answer Food Chain	Partially correct answer	Non-Scientific Belief	Confused Misconception	Confusion with other scientific term	Factual Misconception	No answer
A linear network of links in a food web starting from producers such as grass or trees using solar	Food chain in straight line, starts with producers, organisms depending on others for food,		Where one thing is related to another, chain for animal		Flow of food starting from plants, process of how living things depend on each other, refers to division of living	14

Correct answer Food web	Partially correct answer	Non-Scientific Belief	Confused Misconception	Confusion with other scientific term	Factual Misconception	No answer
radiation to make food and, ending with apex predators like whales or bears	describing how energy flows, straight chain from producers to consumers,	food, how food is being used,			things into three groups-herbivores, carnivores and omnivores, organisms that are dependent on each other,	
A network of food chains or feeding relationships by which energy & nutrients are passed down from one species to another	How food chains are connected , combination of many food chains, showing relationship of living & their dependents, how living things feed each other, inter-relationship of living things on how they feed each other, interlink of food chains in an ecosystem, integration of many food chains	One thing is linked to many, items on the web are related ,			How bigger organism is dependent on smaller one, animals who eat other animals & insects for survival, inter-dependence of organisms on each other, how animals & people depend on each other, different groups of food being brainstormed by a particular concept	17

Table 3- Ingestion and Egestion- ingestion might have been confused with injection which is forceful introduction of food or any material which is not implied here. Egestion is undigested, inabsorbable part of food that is thrown out. There seems a lot of confusion as large no.(16, 18) of respondents have not answered the terms. Other wrong responses indicate weird thinking.

Correct answer Ingestion	Partially correct answer	Non-Scientific Belief	Confused Misconception	Confusion with other scientific term	Factual Misconception	No answer
Consumption of a substance by an organism,	Taking in food through mouth, taking in food from mouth to stomach, taking something in,	Something that you take into your body,	Taking something into mouth,	Taking in of food by blood to all parts of body,	Breakdown process of food,	18

Correct answer Egestion	Partially correct answer	Non-Scientific Belief	Confused Misconception	Confusion with other scientific term	Factual Misconception	No answer
Discharge of undigested waste material, specifically defecation	Taking food out, removal of food as a waste,	Food being removed out of the body,	Ejecting or putting out something from inside, passing out unused nutrients,	Chewing of food in mouth,	Breakdown of food,	16

Table 4- Insects and Arachnids- Insects with no wings also exist eg beetle. The correct answer is insects have tracheal type of respiratory system and three pairs of walking legs. Definition of Arachnids is correct as given in scoring key.

Correct answer Insects	Partially correct answer	Non-Scientific Belief	Confused Misconception	Confusion with other scientific term	Factual Misconception	No answer
Invertebrates with 3 body parts-H, T, A, 3 pairs of jointed legs, compound eyes, 2pairs of wings and a pair of antennae	3 body parts & 6 legs,	Small animals with legs,	Small micro-organisms, Animals with 6 legs & 2 body parts, Animals with 6 legs, animals with 2 body parts, animals without legs	Animals with 8 legs,		18

Correct answer Arachnids	Partially correct answer	Non-Scientific Belief	Confused Misconception	Confusion with other scientific term	Factual Misconception	No answer
Invertebrates with 2 body parts-C-th & A, 4 pairs of legs & no antennae,	Animals with 8 legs,	Big animals,	Animals with 6 legs, Animals with 4 legs, animals with more legs,			18

Table 5- Pollination and Fertilization-confusion with male gametes and pollen and highest no. (17, 20) have not answered these terms. Pollination is first step in fertilization during which transfer of male gametes takes place. Else, the definitions are correctly defined as in scoring key.

Correct answer Pollination	Partially correct answer	Non-Scientific Beli	Confused Misconception	Confusion with other scientific term	Factual Mis-conception	No answer

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The act of transferring pollen grains from male anther of a flower to stigma of ovary	Male, female gametes contacting through insects, pollen grains falling on stigma, pollen grains released into stigma, transfer of pollens through winds & insects, carrying pollen grains from one plant to other,		Process where ovary meets ovules, Meeting of male & female gamete to produce fruit / zygote,		Taking seeds into other plants, pollen falling from stigma, anther taken to stigma, pollen goes from one plant to another, when male & female gamete fertilize to form zygote,	17

Correct answer Fertilization	**Partially correct answer**	**Non-Scientific Belief**	**Confused Misconception**	**Confusion with other scientific term**	**Factual Misconception**	**No answer**
Process of fusion of two gametes leading to zygote formation.	Male gamete coming in contact with female gamete, male & female gamete fuse together,		Pollen fertilizing the egg, decomposing dead plants into soil, transfer of pollen grains down the ovary, reproduction in ovary of flowers, Meeting of male & female gamete at one place,			20

Table 6- Physical breakdown & Chemical breakdown-physical breakdown is for increase in surface areas so that large pieces are broken down to smaller pieces. Physical breakdown is also possible without teeth, which probably is confused by some respondents. In chemical breakdown large chained molecules are broken down to smaller chained molecules, thus matching with definitions in scoring key.

Correct answer Physical breakdown	**Partially correct answer**	**Non-Scientific Belief**	**Confused Misconception**	**Confusion with other scientific term**	**Factual Misconception**	**No answer**
Large pieces of food broken down to small pieces which are subsequently accessed by digestive enzymes Physiological process	Food is broken down physically, Food is broken with teeth in mouth,	Physical breakdown while playing (injury while playing), natural breakdown	Helps in formation of saliva			15

of food break down Starts in mouth,

Correct answer Chemical breakdown	Partially correct answer	Non-Scientific Belief	Confused Misconception	Confusion with other scientific term	Factual conception	Mis-	No answer
Break down of large, insoluble food into small water-soluble molecules so that they can be absorbed readily, Includes mechanical & chemical digestion	Food mixed with chemicals inside stomach & intestine, breaking of food in stomach, By use of chemical such as HCL, food broken down by adding of enzymes, breakdown of food in cells,	Artificial Break down	Using teeth to break down food		Helps in formation of acid, occurs in other parts of body, ,occurs where HCL is released to break food, When saliva is added to break down all saturated fats, helps in formation of acid, occurs in other parts of body where HCL is released, breakdown with the help of HCL,		18

Table 7 - Vertebrates and Invertebrates-

Vertebrates are Animals with internal skeleton or backbone and Invertebrates are animals that neither possess nor develop internal skeleton or backbone. A few have factual misconception as they define vertebrates as insects with backbone. Also bones and backbone are different. Majorities have tried to answer these terms and only 10 respondents have not answered.

Correct answer Vertebrates	Partially correct answer	Non-Scientific Belief	Confused Misconception	Confusion with other scientific term	Factual Mis-conception	No answer
Animals with internal skeleton or backbone	Animals with backbone		Animals with bones,		Insects with backbone,	10

Correct answer Invertebrates	Partially correct answer	Non-Scientific Belief	Confused Misconception	Confusion with other scientific term	Factual Mis-conception	No answer
Animals that neither possess nor develop	Animals without backbone, animals					14

internal with no
skeleton or bones
backbone

After categorizing these misconceptions, their percentage was calculated and tabulated as indicated below-(sample size n=65)

TABLE 8: Table showing the classification of the concepts with percentages

Concept	Correct answer-%	Partially correct-%	NB-%	CM-%	FM-%	CS-%	Un answered-%
Breathing	20.0	34.1	03	-	38.4		04.4
Respiration	-	24.6	07.7	26.1	17.6	20	04.0
Food chain	-	24.6	-	41.5	18.6	-	15.3
Food web	-	32.2	24.6	-	24.6	-	18.6
Ingestion	-	43.1	-	29.2	-	-	27.6
Egestion	-	23.0	12.3	24.6	12.3	7.7	20.0
Insects	9.7	20.0	18.6	26.1	13.3	-	12.3
Arachnids	15.3	18.6	03.1	15.3	20.0	-	27.6
Pollination	15.6	29.2	-	15.3	24.6	-	15.3
Fertilization	20.0	26.3	-	35.3	15.3	-	3.0
Physical breakdown	-	46.1	20	15.3	-	-	18.6
Chemical breakdown	-	50.0	-	15.3	21.3	-	13.4
Vertebrates	37.0	9.2	-	38.4	-	-	15.3
Invertebrates	37.0	26,3	-	-	31.4	-	05.3

Abbreviations used: (NB)- Nonscientific Belief
(CM)-Conceptual Misunderstanding
 (FM)-Factual Misconception
 (CS) Confusion with other scientific terms

RESULT AND DISCUSSION

The data collected and presented in the above table has been further analyzed concept-wise and category-wise as follows-

Out of 14 concepts, just half that is 7 concepts were correctly defined by few students. Vertebrates and Invertebrates were higher in percentage of correct definition and insects were the lowest in terms of percentage of correct definition. Non-scientific belief was seen in half of the concepts. It was highest in case of Food web and lowest in case of Breathing. Breathing, Food Web and Invertebrates had no confused misconception. Ingestion, Physical breakdown and Vertebrates did not indicate any factual misconception. Confusion with other scientific terms was seen in case of respiration and egestion. All the concepts were unanswered by a fraction of subjects, maximum in case of Ingestion and Arachnids and minimum in case of Fertilization. The silence or no answer was indication of lack of certainty. However, 'No answer' response was not given by the same student teachers, that is there was no single concept that was not defined by anybody, indicating that there was no concept that was unfamiliar to student teachers. These wrong answers - confused misconception, confusion with other concepts or factual misconception was probably because of a wide gap in between their schooling time and their training time now.

Observations on each concept individually have been presented as below-

1. **Breathing:** Only 20% subjects have answered this correctly. 34.1 % answered in a partially correct way. Very few that are 03 % have confusion with artificial breathing by the way they defined breathing. 38.4 % have factual misconception either about the gas to be breathed in or the organ/s involved in it. About 4 .4% did not answer.

2. **Respiration**: none defined it correctly. Partially correct definitions were given by 24.6 % subjects. About 7.7 % had a non-scientific belief that respiration is sweating after breathing or exercise. 26.1 % subjects had confusion with ingestion or osmoregulation. About 17.6 % student teachers had confusion with other scientific terms such as circulation or perspiration or artificial respiration. About 20% student teachers had developed factual misconception saying that respiration is Breakdown of energy resulting in sweating, or sharing of air to another person, or need of breathing with another person's assistance. About 4% did not answer.

3. **Food chain:** None defined it correctly. About 24.6 % were partially correct in defining food chain. There was none expressing non-scientific belief. However 41.5 % indicated confused misconception saying that it is where one thing is related to another, chain for animal food, how food is being used. There was no explanation indicating confusion with other scientific terms. About 15.3 % subjects did not answer the concept at all. The explanation such as- flow of food starting from plants, process of how living things depend on each other, refers to division of living things into three groups-herbivores, carnivores and omnivores, organisms that are dependent on each other – were expressed by 18.6 % indicating factual misconception of Food chain.

4. **Food Web**: This was also not defined correctly by anybody in the sample. Partially correct definition was given by 32.2 % subjects. Nonscientific belief was expressed by 24.6 % with the answer- One thing is linked to many, items on the web are related, There was none explaining confused misconception or confusion with other scientific terms. 24.6 % indicated factual misconception. About 18.6 % subjects did not define the concept.

5. **Ingestion**: None defined it correctly. About 43.1 % subjects defined with partially correct answer. None expressed non-scientific belief. 29.2 % explained the concept indicating confused misconception. There was none having factual misconception or confusion with other scientific terms. About 27.6 % subjects did not answer this term.

6. **Egestion**: This was also not defined correctly by anybody. About 23.0 % subjects defined it in a partially correct way. About 12.3 % subjects had expressed non-scientific belief by saying that it is Food being removed out of the body. About 24.6 % subjects indicated confused misconception by saying that it is Ejecting or putting out something from inside, passing out unused nutrients, 12.3 % subjects indicated confusion with other scientific terms and 7.7 % subjects indicated factual misconception, whereas, 20.0% subjects did not answer this.

7. **Insects:** About 9.7 % subjects defined this term correctly, 20% gave partially correct definition. About 18.6 % expressed it as non-scientific belief by defining it as small animals with legs. About 26.1 % subjects defined it indicating confused misconception. About 13.3 % subjects indicated confusion with other scientific terms. There was none expressing factual misconception, but 18% subjects did not answer.

8. **Arachnids**: About 15.3 % subjects defined it correctly, while 18.6 % subjects defined it in a partially correct way. 3.1 % indicated their nonscientific belief. 15.3 % subjects had confused misconception. Those indicating confusion with other scientific terms were 20 %. None indicated factual misconception and 18% did not answer.

9. **Pollination**: About 15.6 % subjects defined the term correctly, whereas 29.2 % definitions were partially correct. There was none having nonscientific belief or confusion with other scientific terms about this concept.15.3 % indicated through their definition the confused

misconception. About 24.6 % subjects indicated confusion with other scientific terms.15.3 % did not answer the concept.

10. **Fertilization**: There were 20 % correct answers, 26.3 % partially correct answers and none were non-scientific beliefs about fertilization. 35.3 % indicated confused misconception, 15.3 % indicated confusion with other scientific terms, none had factual misconception and 3.0 % had no answer for the concept.

11. **Physical breakdown:** None defined the concept correctly and 46.1 5 defined it partially correct. About 20% indicated non-scientific belief, 15.3 % had confused misconception, none had confusion with other scientific terms or even factual misconception. About 18.6 % did not answer.

12. **Chemical breakdown**: None defined the concept correctly and 50% defined it partially correct. None indicated non-scientific belief. 15.3 % had confused misconception and 21.3 % had confusion with other scientific terms, whereas, none had factual misconception and 13.4 % did not answer the concept.

13. **Vertebrates:** About 37.0 % subjects defined the concept correctly, 9.2 % defined it partially correct and none had non-scientific belief. 38.4 % indicated confused misconception; none had confusion with other scientific terms nor for factual misconception and 15.3 % did not answer the concept.

14. **Invertebrates:** About 37.0 % subjects defined the concept correctly, 26.3 % defined it partially correct and none had non-scientific belief or confused misconception. 31.4 % indicated confusion with other scientific terms, none had factual misconception and 5.3 % did not answer the concept.

SUMMARY

The data presented in these tables reveal that student teachers have developed either Conceptual misunderstanding or Confusion with other scientific terms or have confusion in the form of factual misconceptions. Although all of these were not observed in relation to all of the concepts considered, yet in all of them the fraction of student teachers answering them correctly or partially correctly were just a little more than 50%. This means that in all the subjects the concepts developed were not appropriate. They had either used their non-scientific belief or have developed conceptual misunderstanding, or factual misconceptions or confusion with other scientific terms, but of course with varied percentage. In either case the scenario is alarming. These prospective teachers will teach these concepts or related material in the way they have understood and not the way they should be taught. The concern of the researchers is not on the quantity of misconceptions, but on its remarkable existence and future use in a complex teaching-learning process which is based on teachers' knowledge, learners' understanding of concept to be taught and technique/s involved in its teaching.

CONCLUSION

It could be concluded from this study that student teachers at B.Ed. level do have misconceptions about these scientific terms. These misconceptions could be broadly categorized into four types- viz. Nonscientific Belief (NB), Conceptual Misunderstanding (CM) Factual Misconception (FM) and Confusion with other scientific terms (CS) in various proportions and in case of various scientific, Biology-related terms. This would get reflected in their teaching, if not corrected a priory.

SUGGESTIONS

The findings of this study could inform the colleges of Education that it is vital to check the concepts the student teachers have before they pursue the course in Science Education. As stated by Trowbridge et. al. "Unlearning of preconceptions might prove to be most determinative single factor in the acquisition and retention of subject matter knowledge." This could be checked through short tests preferably at the beginning of the session. It could also be helpful for the primary teachers to consider before they start teaching science to primary class students. This will enable them to assist primary school students develop and refine young children's concepts properly. The researchers are of the opinion that science teaching in schools is not that effective as it should be. If science teaching-learning and results of school are to improve, if development of scientific temperament is to be fostered, then elementary school science teaching has to be enhanced. This also suggests that most of the researches are utilitarian that help develop knowledge, but curiosity-driven research would help lead to popularizing the subject, consolidate the concepts and developing interest in learners.

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