

ADDIS ABABA UNIVERSIY  
SCHOOL OF GRADUATE STUDIES  
INSTITUTE OF LANGUAGE STUDIES

ANALYSIS OF APPROPRIATENESS AND USAGE OF PHYSICS  
TERMS IN GRADE SEVEN AND EIGHT STUDENTS' PHYSICS  
TEXTBOOKS: FOCUS ON OROMO

BY  
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ANALYSIS OF APPROPRIATENESS AND USAGE OF PHYSICS TERMS IN  
GRADE SEVEN AND EIGHT STUDENTS' PHYSICS TEXTBOOKS: FOCUS  
ON OROMO

By:

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Approved by the board of Examiners

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**Signature**

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## Abbreviations and Symbols

LSp	Language for Special Purposes
LSG	Language for General Purposes
ISO	International Organization for Standardization
Oro.	Oromo
Eng.	English
Amh	Amharic
(A/B)	Grade A page B
Nom	Nominal
Gen	Genitive
pl	Plural
Cop	Copula
Adj	Adjective
Neg	Negation
T	Tense
pf	Perfective
Quest	Questionnaire
No.	Number
m	Male
f	Female
SR	Students' Responses
TR	Teachers' Responses
F	Frequency Count
NT	Number of Teachers
NS	Number of students
I	Item Number in the Questionnaire
*	No Response
Q	Question

## ***Abstract***

*The intention of the paper is to assess the appropriateness and usage of physics terms in grade seven and eight students' physics textbooks. To achieve this objective, a range of data gathering tools were employed. Both qualitative and quantitative data were considered. Text analysis was used to collect terms in students' physics textbooks. Questionnaires and interviews were utilized to gather information from the people that have direct contact with the terms. Based on the concept of term formation and facts about concept of terms, some principles and guidelines were adopted. The guidelines were used as screening devices to appraise linguistic and conceptual appropriateness of the terms.*

*The analyses of the terms reveal that there are terms that are unnecessarily borrowed, lack potential derivatives, orthographically inconsistent, lack motivation, synonymous, ill-defined and non equivalent. Presences of strange sound configuration, conceptually ambiguous terms, difficulty of understanding, lack of cooperation among term developers and term users, mismatch between terms and their respective symbols, lack of dialectal comprehensiveness are some of the challenges identified so far . Nonetheless, the finding indicates that term-related problems have little impact on students' interest towards the subject.*

*The researcher suggests the revision of linguistic and conceptual appropriateness of the terms, collaborative efforts among various stakeholders, re-examination of ways of presentation of terms in the textbooks and reconsideration of means of minimizing the impact of term-related problems on students' understanding.*

# Chapter One: Introduction

## 1.1. Background of the Study

Oromo is one of the Cushitic languages which are widely spoken in Ethiopia. It is predominantly spoken in the country with several dialects (Baye, 1986, p.8 & Mekonnen, 2002, p.1). Different scholars have different names for the language: Oromo, Afan Oromo and Oromiffa are often used. The language has been serving as medium of instruction following the opportunity granted for mother-tongues to be used as medium of education.

The paramount significance of mother-tongue education is undeniable. Progress in the cognitive and affective domains, social, economical, political and behavioral changes of a community are best addressed by effective utilization of mother-tongue education. Related to this, Tonkin (2001) reports that cognitive skills such as the ability to comprehend the central ideas, summarize the main argument, select information and recognize conceptual relationships necessitate employing a familiar language. Likewise, Webb (2000, p.287) points out that if indigenous languages are not considered seriously as medium of instruction, the cognitive, affective and social development of students cannot take place effectively.

Partly based on this understanding and partly due to political motives<sup>1</sup>, currently many indigenous languages are being used as medium of teaching in primary schools in Ethiopia. Oromo, as one of these ethnic languages, has been serving as medium of instruction for more than 15 years. Many people believe that the use of this language as the medium of instruction has overcome the linguistic hindrances that the students had suffered in primary schools. However, it is unlikely to conclude that this practice entirely cured the headache of the language usage since many complaints have been rising both by the students and teachers.

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<sup>1</sup> The expression 'political motives' is used since there was involvement of political representatives in the decision of using the language for medium of instruction.

One of the critics in utilizing this language for medium of instruction arises from lack of sufficient modernized vocabulary to express scientific concepts. For a language to be used as medium of science and to clearly communicate recent concepts, it should possess adequate and appropriate science terms. As a response to this inadequacy, numerous terms have recently been emerging in the language. Nevertheless, such an instantaneous overflow of terms can pose academic challenges. Regarding this, Felber (1984, p.182) affirms that uncontrolled development of terminology gives rise to contradiction and inconsistency which eventually leads to confused condition in communication. He ascertains, "Intermediating and regulatory measure in terminology have become necessary, and such regulatory measures should aim at harmonization and unambiguating of the terminologies of the subject field."

Ritcher (1986) correspondingly, contends that unplanned spread of new terms can pose great difficulty and counteracts the right terminological understanding of the new world. He stresses that consistency of terminology must be held across a language; technical terms should be standardized. Taye (2003) also affirms that morphosyntactic and semantic variation can substantially influence students' comprehension. He identifies four impacts of Amharic terms on students' comprehension of science concepts. Accordingly, first, students are unable to understand some terms. Second, they are not able to read some of the terms. Third, they do not express the subject matter by using the terms. Finally, they have difficulty in conceptualizing the subject matter.

Similarly, Keller (1972) asserts, "knowing a word adds interest to students' task and prevents word list from becoming a mindless code." Accordingly, technical terms that are not known very well can make a text entirely meaningless. Besides, Felber (1972) demonstrates that the worldwide network for information exchange requires standard vocabularies. Furthermore, Christopher (2002, p.37) shows that the haphazard adoption of a particular term to represent a concept can cause problem. Accordingly, the dominant problem with terms is finding the right equivalent as in theory there is only one equivalent. He adds, "Word formation process may differ across languages at macro-level, and the process as well as models they create can lead to semantic confusion."

Hence, the issues of term development and management have been the primary focus of countries that decide to use indigenous languages for schooling. Situation in most African countries after independence is good evidence in this regard (Abduleziz, 1986). In the Ethiopian context, though there had been individual attempts to translate some science terms, the organized activity towards development of terms of science and technology was the phenomenon of the late twenty century. Development of Amharic terms of science and technology was the massive and fruitful project which can be mentioned in this regard (Ermias & Demissu, 1986).

Christopher (2002, p.36) explains that modernizing an indigenous language is an attempt of enabling the language to express rapidly expanding scientific concepts. Therefore, it involves enabling this language to carry high proportion of specialized concepts. Being lexical units of the language, terms are central elements in this concept transfer. Hailu (1968, p.1) asserts that the utilization of vernacular language for scientific communication needs cautious and thorough study of the problems of terms. According to him, to overcome present limits in terminology, the use of scientific methods for effective and efficient manipulation of vernacular languages is necessary. As far as Oromo is concerned, this language has been recently privileged as medium of science. Such recent utilization and subsequent emergence of many terms make its terminology urgent research area.

## **1.2 Statement of the Problem**

There has been rapid emergence of terms in Oromo as mentioned above. Science terms are being expansively developed following the adoption of the language for teaching science. Indisputably, this overflow of the terms can have some linguistic and conceptual consequences which harm students' comprehension. Associated with this, Sharma (1972) signifies that when Indian languages were in a state of transition, they had no well developed stable terminology for science and technology, and this posed difficulty on the delivery of scientific concepts. This shows that providing precise science terms has been a major challenge in using local language for teaching science.

Therefore, this paper will be devoted to analyzing the appropriateness and usage of Oromo physics terms. Regarding appropriateness, the paper will focus on examining the presence of conceptual precision such as absence of synonymy, concept equivalence among terms in source language and corresponding terms in target language, concept transparency and so forth. Linguistic appropriateness includes phonological and morphological accuracy of the terms in students' textbooks. The notion of usage will include how the terms are presented across students' physics textbooks, how target groups perceive the terms and the consequences of deficits of the terms on students' subject conceptualization.

Among three natural science branches that are being delivered at grade seven and eight: Physics, Biology and Chemistry, physics is preferred as domain of focus. This is partly because the researcher has an experience that the students complain about the problems in the domain and partly since biology and chemistry contain chemical and plant names which are difficult for conceptual analysis. As encompassing all grade levels is impractical, grade seven and eight are considered with two assumptions. First, below this grade levels many of science terms are becoming determinologized<sup>2</sup> and are part of general language vocabulary. Second, it is assumed that there is higher term density<sup>3</sup> at these grade levels as compared to the lower grade levels.

### **1.3 Research Hypothesis**

This study will be carried out with the assumption that there is lack of conceptual and linguistic clarity of Oromo physics terms to convey concepts in students' physics textbooks, particularly, in grade seven and eight. It is also assumed that the presence of incorrect usage of the terms in the texts is discouraging the students and contributing to slow subject understanding.

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<sup>2</sup> According to Draskau (1985), 'determinologization' is the process in which lexical items which are known only in specific profession are widely used by speakers outside the profession.

<sup>3</sup> According to Christopher (2002), 'term density' is term-word proportion in certain texts.

## **1.4 Objectives of the Study**

At the end of this investigation, the following objectives are supposed to be achieved.

### **1.4.1 General Objective**

The overall intention of the paper is assessing the appropriateness of physics terms and their usage in grade seven and eight students' physics textbooks.

### **1.4.2 Specific Objectives**

The following specific objectives are intended to be achieved in this paper:

1. to examine linguistic and conceptual appropriateness of physics terms in students physics textbooks.
2. to illustrate how the terms are presented in students' physics textbooks.
3. to check whether the terms are affecting students' subject matter understanding or not.
4. to identify users' attitude toward physics terms.

## **1.5 Scope of the Study**

Only terms within grade seven and eight Oromo physics textbooks are included within the domain of this study since it is in these grade levels that Oromo is specifically utilized as medium for teaching physics subject. The focus is given only for terms in physics domain as term study in principle is domain specific. The outcome of the work will be best relevant to the physics domain. Geographically, the work covers 14 schools in and around three towns that are found in west Harargae zone: Ciroo, Debbeso and Hirna. The towns are selected based on the researcher's experience about linguistic, social and cultural background of the learners.

## **1.6 Significances of the Study**

The study is assumed to have the following significances.

- It will illustrate term-related problems in the domain.
- It contributes to the attempts of modernizing indigenous languages and using them for medium of science.

- It evokes awareness about nature of term-related problems so that responsible bodies will consider them in textbooks preparation.
- It will enhance understanding of physics teachers about term-related problems in physics textbooks.
- Scholars involved in term development may consider the study as input to re-examine the terms that they have been developing.
- The study will also be essential for translators and other scholars who are interested in specialist languages.

### **1.7 Limitation of the Study**

One of big challenges which have faced so far is the shortage of reference books. As will be stated under review of related literature some existing materials are dominantly seminar papers which are content wise not full enough to present detail elaboration about term works. However, attempts have been made to assess all the existing materials and utilize resources from electronic sources as well. The researcher also feels that problems of Oromo physics terms are best addressed if the research were at regional level than zonal level. However, such huge project needs much time, resource and finance.

## **Chapter Two: Literature Review and Theoretical Frame Work**

### **2.1 Review of Previous Works**

Before dealing with theories of terminology and conceptual explanation behind terms, it is better to explore works that have been done on terminology in Ethiopian context. Previous research works on terms of local languages are not many. Among the existing works, many of them are seminar papers. The following are some among works which have relation with terms in general: Ritcher (1984) 'Modern Terminology in Ethiopia with Focus on Amharic', 'Enrichment and Expansion of Amharic Science Vocabulary' by the same person, Addis (1987) 'Some Theoretical Question of Political and Social Terminology in Amharic', Takkele (2000) 'Ways and Principles of Developing New Words and Technical Vocabulary' and Abraham (1972) 'Problem of Terminology in Modern Amharic', Amsalu (1981) 'Principles for Creation of New Science and Technology Terms in Amharic'

Similarly, Assefa (1982) 'Technical Terms in Amharic: Problems and Solutions', Tadesse (1989) 'Term Endorsement in Amharic', Taye (2003) 'Linguistic Challenges on Teaching Science in Amharic with Particular Emphasis on Grade Eight'; 'Terminology Formulation and Usage in Amharic: A Textbook Analysis and Survey of Primary School' by Aragaw in 2009, and 'Term Related Problems in Teaching Oromo at Tertiary Level' by Adugna in 2009. Another work which has a little relation with Oromo terminology is Wondimu (2009), thesis on Afan Oromo as Medium of Science Subject with Focus on Grade Seven and Eight Students in Ghimbi Primary School. His overall intension was to investigate the effect of Oromo as medium of science subject in the secondary cycle primary school.

Two general comments are possible regarding these works. First, scope wise, almost all of them are very broad and are not domain specific. Second, regardless of Adugna (2009), Aragaw (2009), Takkele (2000) and Taye (2003) the above works are not fully devoted research works. Furthermore, among them, only Adugna (2009) is directly related to Oromo terminology. However, there is a huge gap to be filled by present paper which Adugna's (2009) has not covered. First, the focus of Adugna is on linguistics and literature terms which belong to quite different domain. Second, his concern is on assessing how

different terms are variably used by different scholars in teaching Oromo as a subject, not teaching science subjects. Third, this paper illustrates inconsistency in term usage at tertiary level not in students' science textbooks at second cycle primary levels. It is obvious that challenges of physics terms at elementary school can never be the same with problems of linguistics and literature terminology at university level. Nonetheless, the researcher has benefited a lot from these works.

## **2.2 Theoretical Frame Work**

Having said this much regarding previous works, it is essential to explore some of the facts about terms in various literatures. However, such exploration should start with defining terms and terminology as without doing this discussion about appropriateness and usage of terms will be insufficient.

### **2.2.1 Terminology and Terms**

According to Kageura (2002), in term study, maintaining clear distinction between terminology and term is highly significant. This is because the definitions given to terminology and terms vary from scholar to scholar and from approach to approach.

#### **2.2.1.1 Terminology**

Schemil (2006) illustrates the absence of consensus among scholars in defining terminology. He indicates that specialists do not use the term 'terminology' with an unequivocal definition. Terminology is used both for the set of designations belonging to one special languages and scientific discipline that studies the structure, formation, development, usage and management of terms. For instance, according to Kageura (2002) and Calbré (2003), terminology is 'the vocabulary of subject field'. It is vocabulary exclusive to one domain. In the same way, Felber (1984, p.1) indicates that the term 'terminology' is usually utilized to express three concepts. First, it is used as inter- and trans-disciplinary<sup>4</sup> field of knowledge which deals with concept and their representations. Secondly, it can be recognized as the sum total of terms which represent the system of

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<sup>4</sup> Felber (1984) definition of terminology indicates that to study terms specialization in one field is not sufficient.

concept of an individual subject field. Thirdly, it can be conceived as publication in which the system of concept of the subject field is represented by terms.

The first two views will be held in this study. Therefore, terminology is both field of study and vocabulary that represent system of concept in a domain. As group of terms, they are important to transfer knowledge, skills and technology. Terminologies are vital to translate scientific and technical texts.

### **2.2.1.2 Terms**

Felber (1984, p.1) defines, "A term is any conventional symbol representing a concept defined in a subject field". In the same way, Assegedom (1990, p.8) states that terms are words that are used in special fields of human endeavors. Kageura (2002, p.12), on his part, claims that terms are subset of general words. They are functional classes of lexical items. By 'functional' here he refers to communicative rather than syntactic functions. Furthermore, Calbré (2003, p.183) agrees that terms are units of language, units of knowledge and units of communication.

As stated in Draskau (1985, p.96) too, terms are any conventional symbols of concepts which consist of articulated sounds of their own written representations. As to ISO/R<sup>5</sup> 1087, cited in Draskau (1985), a term can be either a word or a phrase. So, a term may contain one or several morphemes. It is also usual to encounter a syntactic group of terms. The group of terms may also encompass derivational elements which are meaningful but incapable of forming an independent term.

Kageura (2002) depicts that the basic function of a term is correctly expressing meaning which is identified within a particular domain. Therefore, meanings of lexical units are characterized by clarification and narrower determination to satisfy the degree of specification required by the domain in which they are used. In the analysis of

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<sup>5</sup> ISO is an international organization which was established to standardize technical terms.

appropriateness of Oromo physics terms, the notion that terms are words peculiar to particular domain is adopted.

### **1) The Difference between Terms and Words**

From explanation of terms given in 2.2.1.2, we can observe that except Felber (1984), other scholars agree that terms are subset of words. Kageura's (2002) argument displays that the difference between terms and words can be illustrated by using the notion of competence and performance<sup>6</sup>. He argues that in the case of words, we can talk about word formation at the level of language competence by neglecting the real word factors. However, he argues, "It would be nonsense to talk of terms in the same way since by their very essence terms have concrete social existence." As to him, a term manifests itself in the actual communication in a domain. The researcher believes that this notion is quite convincing since terms in their very essence exist due to the presence various social contexts.

Draskau (1985, p.97) further investigates that the extent to which a sign is "terminological" is highly dependent on the amount of information required to understand it. He argues that, from perspective of linguistic form, it is hardly possible to identify characteristics of terms which are not observed in words. He has made assertion which is similar with Calbré (2003) and Kageura (2002) in agreeing that an analysis of a term reveals higher degree of precision and special content unknown in language for general purpose.

From the above explanations, it is clear that the features which distinguish a term from a word are precision and social bases. A term is precise and context sensitive since it is used in specific domain. Thus, the linguistic representation of system of concept may exert an important influence on the formation of terms in a domain. This domain relied nature of terms implies that terminologies are functional units having their own conceptual and

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<sup>6</sup> According to Kaguera (2002) investigation of term formation should be domain specific since the nature of a term is influenced by the domain in which it is used.

linguistic patterns. Context sensitive nature of terms can be more illustrated by identifying their position in Language for Special Purpose and Language for General Purpose.

## **2) Place of Terms in LSP and LGP**

Draskau (1985, p.3) presents that language for general purpose is the major one from which language for special purpose of various areas draws. It is language for general purpose foundation which permits the importation of language for special purpose. Language for general purpose has an autonomous existence whereas the existence of language for special purpose is language for general purpose dependent. Nonetheless, the two engage in dynamic interfacing that is terminologization<sup>7</sup> of vocabulary of language for general purpose advances language for special purpose by supplying a new especial content. In the same way, the enrichment of language for general purpose is achieved through determinologization<sup>8</sup> of terms in language for specific purpose.

This implies that varieties of language for special purposes are subsets of language for general purpose. Since varieties of language for special purpose are subset of language for general purpose, it is obvious that terms are also subset of general language vocabulary. In any discussion of language for special purpose, one is in many ways referring to terminology. These positions are clearly reflected in, Calbré (2003), Draskau (1985) and Kageura (2002). For instance, Draskau (1985, p.175) indicates:

*Terminology is the main bearer of information of individual special language. A system in the subject of lexicon of special language is part of system of lexicon of common language. Therefore, in many ways, the scientific investigation of special language comprises lexical, syntactical, grammatical and stylistic investigation of specialist texts including formation of terminological or lexical units, syntagmas, phrases and structure of specialist texts.*

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<sup>7</sup> According to Draskau (1985) terminologization is the process in which vocabulary in language for general purpose receives special content in specific field or domain.

<sup>8</sup> determinologization is the opposite of terminologization.

Based on the notions of these scholars, it can be claimed that terms are words. A word becomes a term when it is used only in specific context, contains special content and becomes conceptually specific. Considering terms as subset of vocabulary of general language is relatively recent perspective. It has opened the door to apply linguistic theories for terminological investigation as will be discussed in the following sections.

## **2.2.2 Theories and Approaches in Terminology**

Taking the position that terms are subsets of general vocabulary, I shall explain the changes that have been taking place in approaches and theories of terminology. This will be crucial to point out the approach to be considered in addressing the objectives of this study. The 'traditional-modern' dichotomy is often used to categorize these 'theories' (Felber, 1984).

### **2.2.2.1 Traditional Theory of Terminology**

Calbré (2003), Kageura (2002) and Sagar (1990) depict that in traditional approach to terminology, precision of concept, synonymy, the semiotic<sup>9</sup> conception of designations, exclusive interest in the lexicon, the synchronic treatment of terms and the priority of written form are emphasized. Kageura (2002) further explains that Traditional Theory of Terminology provides three points as the base for term study. First, accordingly, any term work should start with a concept. The sphere of the concept is independent of the sphere of terms. Second, only the stems of terms are relevant not the rule of inflections and syntax. Last, term study is fundamentally synchronic.

Calbré (2003, p.167) indicates that this approach presents an attempt to make distinction between terminology and linguistics. However, there has been much opposition against this position. Facing such critics, Calbré (2003) asserts, the followers of this approach came up with the some modifications. For example, international standardization of terms was extended to terminology development as a part of language planning. Besides, phraseology was added to the study of terms. Dynamic description of terms was also

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<sup>9</sup> According to Felber (1984) terms are symbols which are assigned to the concept that precedes, and this concept-term designation is perceived as semiotic designation

introduced. However, controlled synonymy, the significance of written form and precision of concept were maintained. The old approach has been criticized for isolating term study from word, focuses only on content terms and emphasizing synchronic approach alone.

#### **2.2.2.2 Restriction of Traditional Approach**

Calbré (2003) presents the drawbacks of the old approach to terminology. He claims:

*The traditional theory was unsatisfactory for the description of the real data in all their complexity, I have, over the past few years, thought about how a multidimensional theory of terminology could be made broad enough to encompass all the different existing theoretical positions. And so, from my background in linguistics, I was determined to delineate this broad theoretical framework and within it to develop an approach to the description of terminology on the basis of a theory of natural language which describes and explains terminological units (Calbré, 2003, p.188).*

According to Kageura (2002, p.17-18), the traditional theory of terminology has numerous limitations. First, the precedence of concept over term is not clear. He argues that if the sphere of concept is independent of the sphere of term, there is no guarantee that the concept understood has any meaningful relation to the sphere of term. Second, the claim that only term of concept is relevant to terminology is not acceptable as the actual distribution of the morphological and syntactic rules in terminology belongs to the sphere of parole. Thus, morphological and syntactic study of terms cannot be excluded from study of terms. Third, terminological view of language is not necessary a synchronic one. Diachronic investigation of terms is also possible. He stresses, terms' being parole is a clear indication for them to be studied diachronically.

Regarding this, Calbré (2003, p.171) points out that the critics of traditional theory of terminology come from three sides: from cognitive science, from language science and from communication science. Particularly, linguists and sociolinguists have questioned the rigid division of general and specialized language. Thus, they have formulated general hypothesis which leads to models in which the general and specialized language can be

integrated. As to this critic, besides the formal aspect of language, linguistic model for terminology must consider the cognitive and functional aspect of language. We can observe that precision of terms and absences of synonymy which are emphasized in the old approach have not been the focus of criticism. Thus, it will be considered in the analysis of Oromo physics terms. Nonetheless, to set the full approach to be considered in this study, recent trends to terminology should be presented.

### **2.2.2.3. Recent Trends to Terminology**

As traditional approach has limitations mentioned above, scholars have been searching for comprehensive new approach to terminology. According to Calbré (2003, p.173), now days, scholars have three views regarding recent relative position of terminology. The first group of scholars tries to integrate terminology with linguistics without neglecting the established theoretical and methodological functions. They seek for very wide and liberal understanding of linguistics. The second group of scholars completely rejects traditional approach to terminology and aims at building a new approach to terminology. The third group of scholars stresses the need to adapt the old approach to the achievement in cognitive and functional linguistics. Calbré (2003), Kageura (2002) and Sagar (1990) are proponents of the first perspective. Therefore, this perspective will be held in the analysis of appropriateness and usage of Oromo physics terms. This approach will be considered to apply linguistic facts in term analysis.

Citing Sagar (1990), Kageura (2002) forwards three dimensions of terminology: linguistic and communicative, cognitive and automatic processing<sup>10</sup> of terms. Many scholars such as Mayer and Macknotosh (2000), Pearson (1998) and Tammerman (1995) as indicated in Kageura (2002) analyze terms in use. Calbré (2003) too, claims that terms can be studied from different perspectives: the subject field oriented approach, the philosophy oriented approach and the linguistic oriented approach. The linguistic oriented approach has made its base on the idea that terminologies are subsets of lexicon of special language. It applies linguistic tools for terminological phenomenon. While subject oriented study focuses on

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<sup>10</sup> According to Kageura (2002) automatic process is the method in which all terms in a domain is investigated by the help of computer.

conceptual classification of terms, philosophical oriented approach focuses on term-concept assignment and relationship between concepts. As a result, combination of philosophical and linguistic approach can be adopted for the study under consideration.

Based on the intended outcomes, there are two types of term works. These are descriptive and prescriptive terminology. The task of descriptive terminology is to find the existing assignments of terms to concepts in various subject fields and to investigate the existing relationships of the concepts concerned. Descriptive terminology work is a valuable preliminary stage of prescriptive terminology work (Draskau, 1985 & Felber, 1984). These two perspectives are not independent to each other as indicated in Calbré (2003) and Kageura (2002).

As linguistic and conceptual appropriateness and usage of terms are focuses of the investigation, the notion of conceptual precession and absence of synonymy mentioned in old approach will be considered in the concept analysis. These two points are not refuted by opponents of recent approach. Among three dimensions mentioned by Kageura (2002) and Sagar (1990), the combination of linguistic and communicative and cognitive approaches will be held. Thus, following linguistics approach Calbré (2003) presented earlier, theory of natural language will be applied to analyze linguistic features of the terms. Moreover, both linguistics and terminology facts will be used to analyze conceptual feature of terms. Finally, the way Oromo physics terms are presented in students' physics textbooks and the way they are perceived by the users are assumed to be communicative. Therefore, before introducing guidelines and principles for linguistic and conceptual analysis of terms, it is vital to provide the existing facts about linguistic and conceptual nature of terms and term usage.

### **2.2.3. Term Formation in Oromo**

In any language, term formation involves combination of various linguistic components. Terms are combination of sounds. Nonetheless, all sorts of combinations of all sounds may not result in meaningful term in a language. There are specific possible sounds which are configured in specific order in the language. Therefore, to make reasonable judgment

on the appropriateness of a term, it is crucial to primarily present the existing phoneme inventories and their combination potentials.

### **2.2.3.1 Phonemes and Phoneme pattern in Oromo**

As Ishetu (1981), Oromo has 29 phonemic inventories among which five of them are basic vowels, and the remaining 24 are consonants. There is one to one correspondence between a phoneme and grapheme in the language. Length and gemination are phonemic in the language. The five basic vowels are /i/, /e/, /a/, /o/ and /u/. Moreover, each vowel has corresponding long vowel (/ii/, /ee/, /aa/, /oo/, /uu/). The 24 consonants in the language are /p', /b/, /m/, /w/, /f/, /t', /t/, /d/, /d', /s/, /n/, /l/, /r/, /c', /s', /c', /□/, /ñ/, /y/, /k', /k/, /g', /ʔ/, and /h/. There are also borrowed sounds which are used in the language. These include sounds such as /v/ and /p/, /z/, /s' and /z/. These sounds are common particularly in physics terms which are borrowed from English as will be presented latter.

As far as Oromo phonotactics are concerned, Wako (1981, p.36-40) identifies that neither initial nor final consonant clusters are found in Oromo. He classifies consonants in the language in to four. The first category includes consonant phonemes that do not combine with any other consonant phoneme as the first member to form cluster. Phonemes within this category include / p', /t/, /t', /d/, /d' /ʔ/, /s/, /c', /c' and /□/. The second category encompasses consonant phonemes that do not combine with any other consonant phonemes as second member to form cluster. These include phonemes such as /l/, /n/, /r/ and/ y/. The third category contains consonant phonemes that never combine with other consonant phonemes. These consonants are /h/ and /w/. The final category includes consonant phonemes that combine with other consonants phonemes either as first or second member to form clusters. These consonants are /b/, /k/, /k', /f/, /g/, /s', /m/ and /n/.

There are four syllable structures in Oromo: CV, CVV, CVC and CVVC. The structures indicate that vowel sounds do not appear at the beginning of syllable in Oromo. It can also be observed that nucleus alone cannot serve as a syllable in the language. There are also restrictions regarding position of some phonemes. The consonant phoneme /ñ/ and /p' do not appear before vowel phoneme /i/. The consonant phoneme /b/, /t/, /k/, /s/, /c', /ñ/ and

/w/ are also absent after the vowel phoneme /e/. The consonant phoneme /w/, /□/ and /ʔ/ do not occur after the vowel phoneme /i/ (Wako, 1981).

### **2.2.3.2 Methods of Term Formation in Oromo**

Here are explanations of ways of term formation in Oromo including illustrative examples. However, it should be noted that, in this sub unit, only methods of term formations that are observable in the formation of physics terms in grade seven and eight students' textbooks are presented.

Terms can be formed in different ways in various languages. Deferent scholars have presented a number of word formation processes in different languages. Anber (1986, p.71), Assegedom (1990, p.11), Fikredingil (1973, p.05-10), Leon (1986, p.67), Polacek (1986, p.48-49), Rahingson (1984, p.68), Takkele (2000), Taye (2003), Temesgen (1993) and Ullmann (1973) indicate various ways of developing terms. For instance, Taye (2003) identifies methods such as translation, coinage, extension of meaning, adoption, and transliteration in Amharic. Ullmann (1973) also displays that the process of lexical expansion falls into four broad categories: purely arbitrary coinage which is often rare, combination of the existing words, borrowing and change of meaning which is often assumed very economical.

Sager (1990) also presents two types of term formation in relation to pragmatic circumstances of their creation: primary term formation and secondary term formation. Primary creation is the formation of a concept. He calls it 'monolingual'. Secondary term formation occurs when a new term is created for an existing concept in two cases. The first is as a result of the revision of a term in the framework of a single monolingual community. This is creation of a term in the context of a 'normative document'. The second is due to transfer of knowledge to another linguistic community in which a corresponding term needs to be created. Many of the terms that will be presented in this study are possibly formed by secondary term formation.

## 1) Derivation

According to Yule (2006, p.57), derivation is accomplished by means of a large number of affixes which include prefixes, suffixes and infixes. Derivation is the major term formation process in Oromo. Temesgen (1993) identifies the following derivational processes.

### a) Nominalization

As Temesgen (1993, p.8), nominalization is the process of forming nominals from various word categories. He identifies various types of nominals. The first one is abstract nominals. They are derived from adjectival and nominal bases by addition of suffixes such as /-ummaa/, /-uma/, /-ina/, and /-eeñña/. Accordingly, the suffix /-ummaa/ and /-uma/ are formally similar but only /-ummaa/ occurs with nominal bases. Abstract nominal can also be derived from adjectives. He indicates that /-ina/ and /-eeñña/ which appear only with adjectival bases. They are similar in form, but their distribution is unpredictable since they are in some cases free variants and in other cases substitute for one another. There are many Oromo physics terms that are formed by utilization of these suffixes. For instance, *gita?*-*ummaa* 'conservation' is formed by adding the suffix /-ummaa/ to the base word *gita?*-, *holla-nnaa* 'vibration' is formed by adding the suffix /-ina/ to the base word *holla*- 'shivering' , and *fag-eeñña* 'distance' is derived from root word *fag*-. 'far'

Process and action nominal are other nominal types. As Temesgen (1993, p.10), process and action nominals refer to the fact, the act, the quality or occurrence of the bases from which they are derived. In Oromo, such nominals are derived from verbal roots by adding affixes /-iččaa (-ččo)/, as in *fūgičča* 'track', /-isa/, as in *firfirsaa* 'spraying', /-umsa/ as in *taa?*-*umsa* 'placement', /-a/ as in *yaa?*-*a* 'medium' and /-aati/ as in *kuf-aati* 'failing'. As to him, the difference between /-aa/ and /-a/ can be accounted for syllable structure in that /aa/ is found when the vowel of the base is short and /-a/ is used otherwise. The third nominal type is resultant nominal. He claims some of the above affixes are also used in formulation of resultant nominal from the verbal roots. Accordingly, these may be homophone but there are also other suffixes such as /-tee/, /-ii/, /-čču/, /-oo/ and /-suu/.

The fourth nominal types are gerundive nominal and manner nominals. Gerundive nominals are derived from verbal roots by addition of /-uu/as in *firfirs-uu* 'spraying' and *barbaad-uu* 'finding', *deem-uu* 'moving' others. According to Camrie, (1985, p.354) as cited in Temesgen (1993, p.11), manner nominal refers to the means or ways of doing something. They are derived from verbal roots with suffix /-ii/, /-umsa/ and /-aatii/ as can be observed in; *rukaan-ii* 'hitting', *gaʔ-umsa* 'efficiency' and *kuf-aatii* 'failing'. The last nominal types are instrumental nominal and agentive nominals. Instrumental nominals are formed with /-ata/and /-tuu/. They include words such as *buuf-ata* 'station' and *haam-tuu* 'sickle'. Agentive nominals are derived from verbs of action, and have meaning like 'one who does the action of verb'. In Oromo they are derived with suffixes such as /-aa/ as in *saffis-aa* 'one who is fast' and /-tuu/ as in *mur-tuu* (f)'cutter'.

#### **b) Verbalization**

Verbalization is the second derivative type in Oromo. The first is causatives verb which is derived from verbal roots by adding affixes /-is/ or /-si/ as in *dabar-si* 'transmit'. It can also be derived from verbal and adjectival. According to Temesgen (1993, p.23), stative verbs are verbs which denote qualities or attributes proposed by the subject of the clause in which they appear. It can be derived from adjectivals and nominals with the suffix/-at-/ as in the case of *morm-at-a* 'oppose' and *furdaa-at-a* 'to be big'.

#### **c) Adjectivization**

According to Temesgen (1993), adjectivization is the process of forming adjectives from other lexical categories. In Oromo, adjectives are formed by adding morphemes such as /aa(-tuu)/ as in *furd-aa* 'tall' and *hoʔ-aa* 'hot'. From stative verbs like *diim-at-*, one can also drive adjectival *diim-at-aa* 'becoming red'. In some ceases, the base to which the affix is added is the stative as in *ʔulfaat-aa* 'heavy' and *jab-aat-aa* 'being strong'. Other adjectives are formed with /-ssa/ as in *jabe-ssa* 'make strong'. Still other adjectives end in /-ee/, /-uu/, /-ii/and /-oo/as indicated in, *gad-ee* 'misbehaved' and *ded-ii* 'raw'. However, Temesgen (1993) recommends that it seems better to consider the above affixes as simple (non-derived) adjectives.

## 2) Compounding

According to Yule (2006, p.54), compounding is a joining of two separate words to produce a single form. Compounds can encompass various word classes such as nouns, verbs and adjectives. McCarthy (2002, p.60) also illustrates that varieties of word compounding can be distinguished according to their structure. Temesgen (1993) presents that Oromo compound nouns include noun-noun and noun-adjectival. Similarly, Draskau (1985) indicates different ways of combination of terms<sup>11</sup>, and stresses that except some exceptions the process is the same across languages. In Oromo, compound nominal elements are always in derived form as in *rigata daabbataa* 'static friction', and verb-noun as in *kabee bišaanii* 'volume of water'. In the first example, *rigata daabbataa* is the combination of noun *rigata* 'friction' and another derived noun *daabbataa* 'static'. In the second example, the compound term is formed from noun *kabee* 'volume' and another noun *bišaanii* 'of water'. Compound adjective in Oromo include combination of noun-noun as observed in *daddarbuu ifaa* 'light transmission'. In this, the constituents are *daddarbuu* 'transmission' and *ifaa* 'light'. The combination of two nominals, the second of which is agent nominal, is also possible as in *muka muraa* 'wood cutter'. Here, the terms are combinations of *muka* 'wood' and *muraa* 'cutter'. *muraa* is agentive nominal. In the case of adjective-adjective, the two adjectives are paired to form compounds as in *diimaa bareedaa* 'red shiny'. Here, both *diimaa* and *bareedaa* are adjectives.

## 3) Acronyms, Blends and Clipping

As Yule (2006, p.56), acronyms are words which are formed from the initial letters of a set of other words. Acronym can be pronounced either in separate letter or as new single word. Acronyms often keep their capital letters, but many acronyms simply become everyday terms. The numbers of terms that are formed by acronym are many in students' physics textbooks. However, many of the terms which are formed through this process are the first letters of English terms rather than Oromo. Names of units such as kg (kilogram), mm (millimeter), cm (centimeter), hr (hour), ml (milliliter), kw (kilowatt), AC (alternating

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<sup>11</sup> Word combination and term combination are alternatively used due to the approach held above which insists that the two process are not different.

current) and DC (direct current) are some of them. Some terms are represented by single first letter. For instance, *balʔina* 'area' is represented by 'A', *ʔaangoo* 'power' by 'P' and *ʔulfaatina* 'weight' by 'W'.

Regarding blending, Yule (2006, p.56) and McCarthy (2002, p.62) indicate that it is typically accomplished by taking only the beginning of one word and joining it to the end of the other word. In a few blends, combination of the beginnings of both words may appear. There are many terms that are formed through this process in Oromo physics terms. *kal-tokkee* 'unidirectional', *nam-tolčee* 'man made', *badi-dabarsoo* 'semi conductor', and *tuk-lamee* 'two points' are some of them. *kal-tokkee* is blended from two words: *kallattii* 'direction' and *tokko* 'one'. In the same way, *nam-tolchee* 'manmade' is combination of two words: *nama* 'man' and *tolčuu* 'made' while *tuk-lamee* 'two points' is combination of *tukaa* 'point' and *lama* 'two'. It is observable that in Oromo many blended terms under go phonological modification at the end of second constituent; conversion of other vowels to /e/ vowel in this regard.

According to Yule (2006, p.55), clipping occurs when a word of more than one syllable is reduced to a shorter form, usually beginning in casual speech. Marchand (1969, p.441) cited in Takkele (2000, p.73) stresses that clipping involves the reduction of one part of the word. The reduction can be either back (one or two of the first syllable retained) or fore-clipping (one or two of the second syllable retained). The number of words formed through these processes is not many in Oromo physics terms. One possible example in this regard is *guula* 'acceleration'. This term is clipped from a term *guulčisuu* 'riding'. The source term is common among the speakers of the language though it is often known as *gulufsiisuu* in some dialects of the language.

#### **4) Semantic Extension**

As Aragaw (2009, p.9), in semantic extension, the meaning extends from the originally existing term to newly emerged terms. The change includes alternation of parts of speech, metaphorical extension, broadening or narrowing of meaning, semantic drift and reversal. Yule (2006) equates semantic extension with conversion. He defines conversion as a

change in the function of a word. Metaphoric extension is the process by which the sense of existing word is transferred to express new objects or experience. It allows transferring the known sense to express originally unknown sense. Semantic drift is complete change of existing term to express another concept whereas reversal is change in sociosemantic value, for example, change of positive connotation to negative connotation. Semantic drift is also observable in Oromo physics terms.

There are many words that are developed through this process in Oromo. For instance, *yaaጋa* 'medium' is the term that is extended from *yaaጋuu* 'flow' as in *yaaጋuu bišaani* 'flow of water'. The shift is from 'flowing' to 'medium through which some thing flows'. Similarly, the term *ጎaango* 'power' has been used in political and social authorities. The shift of meaning is from social power to nonsocial powers such as electric power. *finčaaጎamuu* 'springing up', has meaning of 'to urinate' in general communication, and it has been used in physics domain to express the coming up of liquids from the ground. *handuura* 'nucleus' likewise means 'navel' in ordinary communication. This meaning is extended to nucleus to express knowledge in the domain possibly due to the fact that navel is found at the center of human body. The same is true for *hoollannaa* 'vibration'. The concept of the term is extended from *hoollačču* 'shivering' as in for instance, *kabbana hoollaččisaa* 'shivering cold' to vibration of things such as wire, air and so forth.

##### **5) Borrowing or Loan Translation**

Yule (2006, p.54) indicates that borrowing is the taking over of words from other languages. Aragaw (2009, p.17), stresses that the linguistic features of borrowed terms should fit in to the linguistic nature of target language. Takkele (2000, p.86-82), citing Jespersen (1972, p.208), depicts that a language can react in three ways to the linguistic components which are incorporated in to its structural system. The reaction can be: rejection or free acceptance.

Significant numbers of Oromo physics terms are borrowed terms. They are borrowed from English, Greek and some of them from Amharic. Terms such as *pilaastikii* 'plastic', *ጎelektirooniksii* 'electronics', *puulii* 'pool', *yuunitii* 'unit' are borrowed from English. Some

other terms are Greek and Latin terms which are borrowed through English. Terms such as *jiiʔoograafii* 'geography', *teermoomeetirii* 'thermometer', and *seelšiiyesii* 'Celsius' are some of the examples. Some are also borrowed Amharic terms. These include terms like *daammanna* 'cloud', *šuboo* 'wire' and others. A special type of borrowing is described as loan translation or claque. In this case, the borrowed component is not linguistic form but concept or meaning. Very often the borrowed term reflects linguistic and conceptual structure of source language. Some of the examples are *hariiroo sirrii* 'direct relation', *soččii daandi sirrii* 'linear motions', *hariiroo fuggisoo* 'reciprocal relation' and others.

## 6) Hybridization and Creolization

Takkele (2000, p.77) defines hybridization as the process of combining linguistic components of two or more languages to form a single compound word. Accordingly, words of unrelated languages can be combined to form hybrid compound words. There are many Oromo physics terms which are formed through this process. The majority of the terms are hybrids of Oromo and English. For instance, *ʔeelee ʔelektiriikaa* 'electric stove' *sirna meetriikii* 'metric system' *soččii makaanikaalaa* 'mechanical motion' *dirree elektiriikii* 'electric field' *éaasaa ʔatamii* 'atomic configuration' and others. According to Takkele (2000), creolization is using words of source language with modifying according to morphological rules of target language. In Oromo, terms such as *falaasama* 'philosophy' and *tiwora* 'theory' are some of the examples.

### 2.2.4 Nature and Definition of Concept

Prior to dealing with guidelines and principles for evaluating conceptual appropriateness of terms, it is essential to make clear the nature of concept and its significance in term analysis. This is plausible as many features of concepts that will be raised here under are mainly parts of the criteria that will be set to examine conceptual appropriateness of terms. Related to this, Booij (1979) contends that the interpretation of complex term is not completely determined by its morphological structure, but it is the result of an interpretation between linguistic structure and non linguistic information.

#### 2.2.4.1 Definition of Concept

Felber (1984, p.115) defines concept as a mental representation of individual object; it may represent only one individual object or a set of individual objects having certain common quality. Equally, to Draskau (1985, p.39), concept is “product of characteristics and abstraction of extra- linguistic entities.”

#### **2.2.4.2 Types of Concepts**

It has been mentioned that concept is combination of characteristics. As to Draskau (1985, p.41), Felber (1984, p.116) and Thaller (1986, p.6), there are two types of concepts: intention and extension. Intention of concept is the aggregate of all characteristics which constitute a concept or "the mutual delimitation of concepts". Extension, on the other hand, has two meanings. The first one is extension by resemblance which is the aggregate of all imaginable species of a concept considered separately. It is aggregate of all individual objects covered by that concept. The second is extension by composition. This is the aggregate of all parts of a whole that is considered separately.

#### **2.2.4.3 Function of Characteristics in Concept Analysis**

As cited in Draskau (1984, p.45), ISO/R21087 defines characteristics as any of the properties that constitute the concept. Likewise, Felber (1984, p.117) defines characteristics as an element which serves to describe or identify a certain quality of an individual object. According to these scholars, characteristic has various classifications:

- a) intrinsic or inherent characteristics-it refers to an object itself, not in its relation to another. It includes shape, size and color of an object.
- b) extrinsic characteristics- it belongs to an object only in its relation to another object. It includes characteristics of purpose and origin.
- c) equivalent characteristics-different characteristics which substituted for each other in a given intention without modifying the expression.

Characteristics can also be either dependent or independent. Dependent characteristics influences the system of a concept while independent characteristics not.

As has mentioned above, the characteristics have various merits in term analysis. Draskau (1985, p.49) and Felber (1984, p.117) present that characteristics are pivotal to identify change in intention<sup>12</sup>, to elaborate and formulate definition of concepts, to structure and order concepts in the system and to confirm conceptual equivalence among terms. In conceptual analysis of Oromo physics terms, characteristics will be used for the same purposes.

### **2.2.5 Usage of Terms in Physics Textbooks**

The way terms are presented in students' physics textbooks and the impact of problems of the terms on the users are further dealt in this section. There are three issues that are intended to be raised here: ways of presentation of terms across students' physics textbooks, term-understanding correlation and the users' outlook about the terms.

#### **2.2.5.1 Presentation of Terms across Students' Physics Textbooks**

According to Draskau (1985) and Felber (1984), there are many factors that should be considered in terms presentation. However, only definitions of terms and their orthographic consistency are presented here.

##### **1) Nature of Definition of Terms**

Definitions and explanations are ways of clarifying concept of terms for the users. Both in-text and outside text definition of terms and the way they are presented have been part of term analysis in terminology. According to Draskau (1985, p.50), Felber (1984, p.160) and Thaller (1986, p.6), there are various types of definitions of terms.

##### **a) Intentional Definition**

Intentional definition is called definition by difference, definition by intention or definition in its classical meaning. Its merit is to describe the intention of a concept. In theory, all characteristics which are capable of determination must be enumerated. However, since enumerating all characteristics inevitably leads to confusion, scholars prefer to make

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<sup>12</sup> Felber (1984), Draskau (1985) and Thaller (1986) define intention as a process which leads to a new concept or the adjustment or implication of human knowledge.

meaningful selection depending on the intended individuals, and context in which definition appears (in isolation or in text). In principle, definition which appears in isolation needs more characteristics than one which is presented in a system.

#### **b) Extensional Definition**

It is sometimes called definition by denotation. It focuses on the determination of the extension of concept. It states in various ways the extension of the concept. Three types of this sort of definition are distinguished. In the first type, all individual objects within the concept are named. In the second, all subordinate terms of a generic term on the same level of obstruction are named. In the third sort, the rule by which an enumeration or determination of extension is achieved is stated.

#### **c) Contextual Definition**

ISO/R 1037 cited in Draskau (1985, p.50) defines contextual definition as "definition by way of an example from actual usage". In this case, the term to be defined is shown in a sentence from which the meaning is known or suggested.

### **2) Orthographic Consistency in Term Usage**

Draskau (1985, p.116) indicates that orthographic consistency should be maintained across texts. He claims that "Terms should probably not present orthographical and morphological variation". He emphasizes that orthographic variation in usage can confuse students. Accordingly different appearance of the same term can confuse the learners.

#### **2.2.5.2 Terminology Vs Subject Matter Conceptualization**

Fikredingil (1973, p.5-10) depicts that it is merely learning through one's own language which is more helpful to reveal scientific facts. Nevertheless, presence of science terms alone never guarantees science concept transfer. Selinker (1979) proves that both native and non-native speakers may not understand scientific texts as science jargons can make transfer of scientific knowledge difficult. Likewise, Christopher (2002, p.38) makes similar remark, "In term-ridden text, jargon overcrowding is assumed to be greater than

the normal level of lexical density. In such texts, the information load is considered to be heavier, often to the extent of being impenetratable to the non-experts."

In Taye (2003), it is also stated that morphosyntactic and semantic variation can pose substantial influence on peoples' comprehension. As stated in Assefa (1982, p.3), the development and prosperity of a society is determined by the nature of the production activity. To mobilize the society towards this development endeavors, their language should express the level of science and technology development requires. If the language is weak in expressing the scientific concept, however, communication can be sluggish. In the same way, Draskau (1985, p.3) presents that lexical factor is one of the factors that affect comprehension of message contained in specialist subject. Communicating information within such subject is possible only with the utilization of most economic, precise and unambiguous term possible.

Ermias and Demissu (1986, p.10) claim that to disseminate science and technology concepts to the society and to the school community in particular, developing indigenous language is crucial. The magnitude of equipping local languages with sufficient and precise vocabulary is to render better service in dissemination of scientific thoughts and knowledge. Polacek (1986) too, contends that vocabulary is part of the language which is the most immediate and helpful to understand the surrounding. In the same way, Massamba (1986, p.68) in his explanation about Tanzanian experience indicates that the transfer of technology cannot be realized without utilizing the language, and the language cannot play this role unless its lexicon is enriched by creation of scientific and technical terms.

In the same way, Bloor and Meriel (2004, p.213) explain that both native speakers and non native speakers found the language of scientific thought extremely difficult to access. Consequently, some educators believe that the language of science acts as barrier to learning in the field, discouraging some children from achieving success in science. These scholars agree that there are also many adults with no technical training or background but need to learn techniques of science jargons. Such practical problems of teaching and

learning in relation to science have led the number of scholars into investigating the nature of scientific writing.

### **2.2.5.3 Users' Attitude toward Terms**

There have been numerous research works which investigate the attitude of language users toward their language; particularly, toward their language for special purposes. Once terms are developed, they should be disseminated for the users. However, after dissemination, some may be assimilated while some suffer rejection. It is easy to create a new term, but difficult to get acceptance by the users (Draskau, 1985, p.16).

According to Takkele (2000, p.11-14), the primary challenge to successful elaboration of unelaborated language can be the attitude of the users. He asserts that the sense of keeping one's language pure is a worldwide challenge. As his assertion, scholars in the field of education are, for instance, not interested in using Amharic terms. They prefer English to Amharic to get international recognition. Accordingly, they are also well aware that if they try to write in Amharic, they will encounter many problems including burden of finding technical terms in the area of their specialization. Hence, he also warns that "If this intellectual difference continues, the possibility of bringing necessary technical terms into effective and meaningful use may be very limited."

### **2.2.6 Guidelines for Analysis of Appropriateness of Terms**

The following are guidelines that have been proposed by different scholars to evaluate the appropriateness of terms. They are also adopted for analysis appropriateness of Oromo physics terms.

#### **2.2.6.1 Appropriateness of Terms from Linguistic Perspective**

Different phonemic natures and ways of word formation of the language have been highlighted with the fact that term formation and word formation are governed by the same linguistic rules. Therefore, to evaluate linguistic appropriateness of terms, rules of word formation can be used. Thus, many of the guidelines that will be used are derived from term formation rules as stated earlier. There are many guidelines that have been

developed by various individuals and organizations for this purpose. However, only some of these principles are adopted here since some of them are language specific and are not be applicable to Oromo.

### **1) The principle of Authenticity**

As Takkele (2000, p.245), the principle of authenticity states "Any coinage for any technical terms must be based on an already existing word in any human language". According to this principle, in term formation endeavor, the phonemes and words in the language under consideration should be utilized as resources. The principle includes the consideration of word formation possibilities in the language. Regarding this, Takkele asserts:

*All existing words and morphemes cannot be eligible since it is not possible to add new words to grammatical categories such as pronouns, prepositions, determiners, quantifiers...etc. New word can only be formed from major lexical categories- nouns, verbs, adjectives and adverbs (Takkele 2000:244-245).*

Accordingly, any coined term should be explainable; they should be traced back to the source of natural language. The term should be either recognized by the speakers of the language or should be acceptable when explained by the individual who coined it. As a result, the constituent of terms and their configuration should be accounted to the existing language. This principle helps to avoid artificial coinage. Regarding this, Draskau (1985, p.116) contends, "The term should not contain superfluous elements." There are at least two things that this principle stresses. First, components of a term to be coined should be taken from the natural language. Second, the way these components are combined together should be based on the convention of arrangement in the language.

### **2) The Principle of Borrowing**

Amsalu (1986, p.19-21), Massamba (1986, p.56-58), Takkele (2000, p.241-244) and Yule (2006, p.66) present that when a technical term is taken from foreign language, the morphophonemic structure of the borrowed term should be modeled on the structure of an actual or possible word of the target language. Aragaw (2009, p.17) further stresses that

the linguistic features of borrowed terms should fit into the linguistic nature of target language.

### **3) The Principle of Manipulability or Derivability**

Draskau (1985, p.116) and Felber (1984, p.197) indicate that terms must be potentially productive of derivatives. This principle states that on the bases of pattern of language a term that can allow potential derivatives should be selected. The developed term should allow derivatives. Correspondingly, Takkele (2000, p.250) stresses that this principle is imperative to know the word category of the newly coined terms and to coin terms from the same word. He further recommends that when a term lacks manipulability, it is better to invent another working term. As Aragaw (2009, p.23), this principle also includes potential terms which can designate new senses by collocation. Similarly, Draskau (1985, p.116) indicates that common affixes in the source language should have corresponding affixes in the receptor language.

#### **2.2.6.2 Terms Appropriateness from Conceptual Perspective**

As with linguistic appropriateness, there are guidelines and principles of evaluating conceptual appropriateness of terms. Many of these principles are derived from theory of concept and facts about concepts in terminology. Just some of these guidelines are presented as follow.

##### **1) The Principle of Motivation**

This principle stresses that the term must be well motivated. It must be logical and self-explanatory to high degree. As a general rule, the term should be persistent in its form though the concept might have undergone radical changes. The formerly existing term might not longer correspond to present fact of paralinguistic reality since this concept may today mean different concept. The form should not be modified to keep pace with technological development. The motivation of the term must also maintain its relationship with that of other terms within the same system (Draskau, 1985, p.113).

## **2) The Principle of Semantic Transparency**

The principle of semantic transparency contends that any term creation mechanism should produce term whose meaning is predictable. Terms should follow familiar and established patterns of meaning which are in use in the language concerned (Takkele, 2000, p.246). This principle does not include name of new products and highly specialized technical terms. Takkele (2000, p.242-146) also indicates that the principle of transparency focuses not on grammatical aspect of the newly coined word but on its semantic aspect. If a coined term lacks transparency, it becomes as an opaque to the users as it has no link with meaningful structure of natural language. Lack of transparency of a term may also lead to rejection by the users. The proper application of this principle is believed to minimize such negative reaction and to maximize chance of acceptability of terms.

## **3) The Principles of Synonyms and Polysemy**

Felber (1984, p.179) and Takkele (2000, p.234-251) present that synonym causes confusion and false impression that more than one concept exist. So, they should be avoided in special language. According to Takkele (2000, p.250), synonymy refers to the presentation of a single concept by more than one lexical unit whereas polysemy refers to the representation of more than one concept or entity by single lexical unit. In principle, it is disadvantageous to have two or more words to refer to the same concept. These do have negative communicative consequences (Ibid).

In special language, the main effort is directed towards avoiding ambiguity. Communication is possible only if a term is permanently assigned to a concept or vice versa. In principle, one term should be assigned to one concept. This principle states that there should be one to one correspondence between a term and a concept. Neither a term shall be assigned to concepts nor shall one concept be designated by many terms. The condition where different concepts are represented by one term is called plurivalence. If two or more words are assigned to a concept, the condition is called synonymy. So, both plurivalence and synonymy should be avoided (Felber, 1984, p.197).

#### **4) Principles of Conceptual Equivalence**

When comparing concepts of a given field, in different languages, some of the concepts may coincide, most of the concepts however, do not coincide; different degrees of equivalency may exist. These degrees of equivalence depend up on the coinciding portions of the intensions of two concepts. The intension of a concept is the aggregate of characteristics which constitute of the concept. As a result, the comparison of concepts is more or less the comparisons of characteristics of the concept concerned. Different degrees of equivalency can exist between two languages (Felber, 1984, p.152). Accordingly, two concepts A and B are equivalent if each characteristic in A is equivalent with each corresponding characteristics in B. The two concepts are non equivalent if each characteristic in the two concepts do not coincide. Besides, Felber (1984) pointes out that the concept of equivalence is not often taken into consideration in terminology.

#### **5) The Principle of Concept Combination**

This principle claims that terms should be formed according to combination rules in the language. Draskau (1985) indicates that constituents of the compound terms vary across languages. Thus, terms within a language should be developed according to the rule of that language. As stated above, Temsgen (1993) identifies different components of constituents in compound terms. The way constituents are combined and the nature of constituent terms determine the resultant concept. Therefore, conceptual change that takes place while constituent terms are compounded should be seriously considered.

Related to this, Draskau (1985, p.93) identifies four kinds of fusion of concepts in compound terms. The first one is determination in which one concept determines another and there by increase the number of characteristics. In this case, the resultant concept<sup>13</sup> becomes subordinate concept or species<sup>14</sup> to the determined concept or genus<sup>15</sup>. The second fusion type is conjunction. In this case, the sum of predications or characteristics of

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<sup>13</sup> Resultant concept is the outcome of combinations of different concepts. It is the result of fusion of various concepts.

<sup>14</sup> According to Draskau (1985) and Felber (1984) species is a type of concept which is subordinate to other concept. For instance, the term 'electric power' is subordinate concept of genus concept- 'power'.

<sup>15</sup> According to the above scholars genus is the independent concept that determines the subordinate concept. In 'electric power', power is genus concept.

constituent concepts form the fusion of an intention. Compared to determination, conjunction occurs as a subordinate concept common to both constituent concepts. The third is disjunction which is the sum of the extension of the constituent concepts. The constituent elements fuse into one common generic or subordinate concept. The last is integration in which various individual objects unite in to one. Therefore, both knowledge of rules of compounding and knowledge of combination of concepts are vital. This notion of fusion of concepts is significant in analyzing the appropriateness of concepts which are formed while term combinations. Therefore, it will be used in chapter four to analyze conceptual appropriateness of compound terms.

### **2.2.6.3 Assessment of Nature of Presentation of Terms across the Texts**

The following are guidelines to assess definitions and orthographic inconsistencies in students' physics textbooks.

#### **1) Definiens-Definiendum Correspondence**

Felber (1984, p.197) discloses that a term should be composed of most significant characteristic of a concept to be designated. It should not contain elements which contradict definition. The concept can be described either by definition or explanation. A definition is a description of the concept by means of other known concepts. It determines the position of this concept in terms of other related concepts. As to Draskau (1985, p. 50), in defining terms, there should be an equivalence between a definiendum<sup>16</sup> and definiens. Definition is significant in determination of concepts, fixation of concept, isolation of concept from other related concepts and setting a concept in relation to other concepts.

The following are some defects which can possibly characterize definitions of terms:

- a) incomplete definition-the definition given for a term is not able to mention the distinguishing characteristics of a term since it misses some of its parts.
- b) excessively restrictive definition-the definition lacks specificity and the characteristics.

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<sup>16</sup> According to Felber(1984) and Draskau(1985), definiendum is a term to be defined while defines is explanation given which is given to define a term.

c) excessively broad definition-the definition doesn't specifically express the concept since it is too broad,

d) circular definition- circularity may reside in the definition itself or in the system of definition (Draskau, 1985, p.55).

If definition is imprecise, that is, contains no clear references, it leads to misunderstanding. Both definition and explanation determine the position of concept of a term in terms of other concepts. In principle, any definition of a term should contain genus and other distinctive characteristics. Christopher (2002), indicates that definitions of words are often given in the form of synonyms though in principle terms should have no synonyms.

## **2) Orthographic Consistency**

Draskau (1985, p.116) recommends orthographic consistency as fundamental guideline in presenting terms. He indicates that this principle has universal applicability and should be considered in term presentation. He claims that "Terms should probably not present orthographical and phonological variation". He emphasizes that orthographic discrepancy in term usage can pose two major difficulties. First, utilizing different orthographic representations for a term can offer false impression that a term is representing different concepts. Second, such form inconsistency can make using the term quite difficult as it will be hard either to find its equivalent or its definition in different sources. Therefore, one form one concept principle will be attained if and only if the term is spelt uniformly.

## **Chapter Three: Research Methodology**

In this section, details of data gathering tools, source of data, sampling techniques and methods of data presentation and analysis are presented. This study involves both qualitative description of terms gathered from physics textbooks and quantitative analysis of information obtained from people who do have contact with the terms. Thus, the research method can be categorized under mixed research method.

### **3.1 Data sources**

Both quantitative and qualitative data were considered. Qualitative data encompass terms that were collected from grade seven and eight students' physics textbooks. Quantitative data were obtained from grade seven and eight students, physics teachers and scholars who have been participating in developing physics terms translated to Oromo.

### **3.2 Data Gathering Tools**

Questionnaire, interview and text analysis were the data gathering instruments which were utilized in this research. Questionnaire and interview were used to gather quantitative information from grade seven and eight students and physics teachers. Only interview was used for scholars that have been participating in physics terms development because their number was small. Text analysis was used to collect qualitative data from grade seven and eight students' physics textbooks.

#### **3.2.1 Questionnaires**

Questionnaires were provided both for grade seven and eight students and physics teachers in the schools under consideration. The questionnaires contain items focusing on students' and teachers' outlook, the relation between term difficulty and subject matter understanding and conceptual appropriateness of the terms. In the questionnaires, close-ended multiple-choice questions and some open-ended questions which enable the respondents to express their feeling in relatively extended way were included. The questionnaires which were provided both for students and teachers were similar. Each

questionnaire contains 18 items. The questionnaires were translated to Oromo as students and teachers may not understand the English version.

As far as the students are concerned, the questionnaires were distributed for the students that were selected according to the producers stated under sampling techniques. The selection and distribution were made both by the researcher and physics teachers in each school. Name of the students who received the questionnaire were recorded by the physics teachers to minimize the number of unreturned questionnaires. Explanation was given for students on some expressions that the researcher thought a little bit difficult for the students. After explanation, the students were allowed to answer the questions at their home. As the students were gathered from different classes, there was no time which was appropriate for all of them to fill the questionnaires in the class. On the next day, physics teachers collected the questionnaires from the students in all classes. All physics teachers in each school also received the questionnaire and returned them on the next day.

### **3.2.2 Interviews**

Discussions were also held with grade seven and eight students, physics teachers and scholars that have been participating in the development of terms of the concerned domain in the form of interview. The discussion was held in the form of one-to-one interview; each participant was interviewed individually. The focus was on the conceptual and linguistic problems of terms, terms usage in the students' textbooks, teachers' and students' attitude towards the terms and the relation between term problems and subject matter understanding. The interview was semi-structured; though some guidelines were provided as indicated in appendix C, the interviewer often raised additional questions depending on the information obtained from interviewee. All responses of students, physics teachers and scholars were taken in the form of note by the researcher.

### **3.2.3 Text Analysis**

All terms in grade seven and eight students' physics textbooks were considered in the analysis. The terms were evaluated by using criteria set to identify the existing problems. To analyze linguistic appropriateness of terms, principle of authenticity, principle of

borrowing and principle of derivability were utilized. For conceptual analysis, principle of motivation, principle of conceptual transparency, principle of synonymy and polysemy, principle of conceptual equivalence and principle of compounding were used. Principle of definiendum-definiens equivalence and principle of orthographic consistency were also used to assess how terms are presented across students' physics textbooks. The division of the principles into linguistic and conceptual dichotomy was made by the researcher just for the sake of convenience. It should be noted that the division is only to show the dominant focus point, and the researcher is aware of the fact that talking about concept without due consideration of linguistic symbols and vice versa are quite impractical.

### **3.3 Sample and Sampling Techniques**

Due to time and resource constraints, it is difficult to include the entire population in this study and in any research endeavor as well. Therefore, to select relevant sample from the total population, the following sampling procedures were applied.

#### **3.3.1 The Schools**

Fourteen schools in west Hararge zone were selected for the purpose of this study. The schools were preferred because of background of the researcher. Among these schools, three of them were considered to sample students. One of the schools, Ciroo No.1 Elementary School, is found in Ciroo town which is the biggest town in the zone. Many of the students in this school have urban experiences. The second school is Hirna No.1 Elementary School which is found in Hirna town. Hirna is smaller than Ciroo. The students in this school have half urban and half rural experiences. The third school is Debbeso Elementary School which is found in Debbeso town. Debbeso is very small town. Almost all students in this school are from farmer family. These schools are considered with the assumption that background of the students may affect their responses. However, the number of physics teachers in these schools was very small. Thus, physics teachers in fourteen second cycle primary schools in and around the above three towns were considered (see list of the schools on appendix A).

### **3.3.2 The Students**

To decide on the number of students to be involved in the questionnaires, both deliberate and random sampling techniques were utilized in both grade levels. 15 % of the total students were considered as sample group in each school. Among sample group in each school, 25% of them were taken from high achievers, 50% from medium achievers and 25% from lower achievers. The same procedure was used to sample both grade seven and grade eight students. The achievement categories of the students were decided depending on their physics first semester result of 2009/10 academic year.

The high achievers are assumed to be those who were in the top 25% of the total students in their physics subject performance. Selection among students within the same achievement category was random. Students' subject performance was considered in the sampling technique with the assumption that the general subject performance of the students can possibly affect their response about terms. Five students from each school and total of fifteen students were also interviewed. Selection of five interviewees from each school was random.

### **3.3.3 Physics Teachers**

Thirty physics teachers who have been teaching physics in 14 schools in and around Hirna, Ciroo and Debesso towns were included in the questionnaire. However, interview was made only with seven teachers in the three schools of these towns.

### **3.3.4 Scholars Involved in Term Development**

Two scholars that have been participating on term development and usage were also interviewed. One of the scholars is language specialist who has been participating on term development which has been launched under the supervision of Oromiya Cultural and Tourism Bureau. The second scholar is physics specialist who has been serving as representative in Oromiya Education Bureau as far as evaluating physics materials such as textbooks are concerned. Discussion was made partly on the bases of the questionnaire guide provided in the appendix C3.

### **3.4 Methods of Data Presentation and Analysis**

Evaluating linguistic and conceptual appropriateness of physics terms in students' physics textbooks was carried out on the bases of conceptual and linguistic guidelines and principles which were set earlier. As far as analysis of concept of terms are considered, besides linguistic knowledge of the researcher, four dictionaries: Oxford Advanced Learners' Dictionary, Elellee English-Oromo-Amharic Dictionary, Harmony English-Oromo-Amharic Dictionary and Dictionary of Science are used. Furthermore, three physics teachers were regularly consulted whenever conceptually doubtful terms were encountered. The consultants were speakers of different dialects. This dialectal variation was considered with the assumption that concept of a term in students' textbooks may vary from dialect to dialect.

Responses obtained from students, teachers and scholars were presented and described in various ways based on the nature of the items. Some of data were presented in table format. To analyze information that was obtained from the respondents, descriptive statistics were utilized. Therefore, percentile and frequency of close ended items were computed.

## **Chapter Four: Data Presentation and Analysis**

In this chapter, data that were collected from grade seven and eight students' physics textbooks, grade seven and eight students, physics teachers and scholars that have been participating in term development and usage are presented and analyzed.

### **4.1 Analysis of the Terms Based on Term Development Principles**

Before starting the analysis of the terms, it is useful to provide general description of the textbooks to be analyzed. Both grade seven and eight physics textbooks are 1997 E.C (2005G.C) versions which are being used for teaching-learning process in the schools. Grade seven students' physics textbook has 122 pages while grade eight students' physics textbook contains 102 pages. Both books have at their back some lists of Oromo physics terms with corresponding English terms. The terms were collected from both textbooks to be presented and analyzed in light of linguistic and conceptual guidelines and principles developed under 2.2.6. All technical vocabularies that exist in the textbooks are considered in the analysis. Around 376 terms were identified excluding various appearances of the same terms.

Then, the terms were categorized according to their source and methods of formation (see table below). English and Oromo are dominant source languages of physics terms. They comprises 170 (45.21%) and 165 (43.88%) respectively. Borrowing and derivation are the main word formation processes that the language employs; 139 and 73 terms respectively are formed through these methods. The figure also displays that there are a lot of hybrid terms in the language. Oromo-English hybrids are common in the terms. The table also shows that backformation and multiple processes are the least utilized method in the formation of these terms. Among the terms considered in the analysis, a few of them are formed by this process. Terms that are formed through blending, creolization, semantic extension and loan translation are also not many. They comprise 3, 3, 9 and 9 respectively.

Methods	Source Languages					
	Amharic	Amh-Oro	English	Oromo	Eng-Oro	Total
Hybridization		1		-	32	33
Back Formation	-	-	-	1	-	1
Blending	-	-	-	6	-	6
Borrowing	6	-	133	-	-	139
Coinage	-	-	-	29	-	29
Compounding	-	-		38	-	38
Creolization	1		2	-		3
Semantic Extension	-	-	-	9	-	9
Derivation	-	-	-	73	-	73
Loan translation	-	--		9	-	9
Multiple process	1	-	-	-	-	1
Acronyms	-	-	35	-	-	35
Total	8	1	170	165	32	376

**Table 1 Sources<sup>17</sup> and methods of term formation**

#### **4.1.1 Evaluation of Linguistic Appropriateness of the Terms**

As stated under 2.2.6, among various guidelines and principles that have been used by many scholars and organizations, some of them are targeted at explaining the linguistic requirements that the terms should fulfill. Some of these requirements are adopted for the purpose of evaluating Oromo physics terms as presented here under.

##### **4.1.1.1 The Principle of Authenticity**

The principle of authenticity asserts that in term formation, words and morphemes in the language should be utilized. Components from which the terms are coined should also be part of a general language. Accordingly, any coined term should be explicable in terms of the general language or target language. Thus, combinations of phonemes and phonotactic arrangements of the coined term ought to be in convincing way (Takkele 2000, p.244-

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<sup>17</sup> Terms which have Latin and Greek origins are included under English terms since Oromo directly borrowed from English.

246). Regarding this, Christopher (2002, p.37) also indicates that new terms are practically formed on the model of existing terms by various word formation processes.

There are two fundamental points that can be grasped from this principle. First, in term formation, words, phonemes and morphemes in general language should be exploited. Second, the exploitation of these linguistic components should be in convincing way. Viewed from these perspectives, there are some terms which are presented with configuration problems in students' physics textbooks. For instance, in *proobileem-oota* (7/14) 'problems', the term has CCVV.CV.CVV.CVV.CV (*proo/bi/lee/moo/ta*) syllabic structure. Nevertheless, consonant cluster doesn't appear at the beginning of the words as presented in 2.2.3.1. Adugna (2009) identifies comparable syllabification problems in Linguistics and Literature terms. He indicates that there are terms that have syllable clusters at the onset and coda though syllable of native words do not exhibit such order.

Often miss exploitation of the morphemes in the language is also visible. For instance, in *sočč-ii daandi marfat-aa* (7/24) 'curvilinear motion', the suffix /-aa/ is agentive suffix. This agent suffix is unintentionally attached to the root verb *marfat-* possibly with the assumption that the final /ar/ in 'linear' is agentive suffixes. Nonetheless, there is no notion of 'the doer of something in the term 'linear'. In contrast, in *marfat-aa*, /-aa/ indicates the one who does the action. This makes the meaning of the term equivalent with 'one who takes the action of rounding'. In the language the word *marama or martoo* is common to express 'curve'. The researcher recommends *marama*. Similar problem can be observed in *gitaʔ-ummaa* (7/62) 'conservation'. As presented above, the suffix /-ummaa/ is abstract nominal suffix which is attached only to non abstract noun to form abstract noun as in *nam-ummaa* 'humanity' *tokk-ummaa* 'unity' and others. However, in this example, the suffix /-ummaa/ is added to the adjective *gitaʔ* 'equal' to form *gitaʔ-ummaa*. The term *gitaʔ-ummaa* is used for 'conservation' as in *seera ʔanisaa gitaʔ-ummaa* 'law of energy conservation'. However, the appropriate term is *gataʔ-ina* 'equality' as abstract nouns are formed from adjective by addition of suffix /-ina/. It appears to be that 'equality' is converted to conservation by semantic extension.

Similar cases can be indicated in *dabars-oo* (8/13) 'transmitter'. Suffix /-oo/ is unnecessary added to the base verb *dabars-* since the appropriate suffix is /-aa/ which forms *dabras-aa*. This because 'transmitter' some thing that makes the action of transmission. Unsuitable use of morpheme is also clear in *seera Ohm* (8/120) 'Ohm's law'. Two problems can be identified here. First, though in Oromo every compound word ends with vowel, the term *Ohm* has no such vowels. Second, the genitive concept expressed in English term 'Ohm's law' is lacking in *seera Ohm*. In Oromo compound terms, genitives are often expressed by length. Therefore, the correct form should be *seera Ohomii*. In general, it seems that the concept of authenticity that Takkele (2000) recommends is not entirely considered in development of Oromo physics terms (see appendix D1).

#### 4.1.1.2 The Principle of Manipulability or Derivability

According to this principle, terms should be potentially productive of derivatives. That is, the developed term should allow derivation of other terms. Though many of the terms in students' physics textbooks are productive in this respect, there are also terms that lack this quality. If we consider the term *guula* (7/6) 'acceleration', it seems that it is formed by backformation from *guulčis-uu* or *gulufsiis-uu* 'riding'. The term should have added different morphemes to express related concepts such as 'accelerate', 'accelerating', 'accelerated', 'accelerator' and so on. However, all of these derivatives are expressed by different unrelated terms<sup>18</sup>.

Many such examples of terms that are used in barren form can be elicited. *humna* (7/6) 'force' is another example. Though in English terms such as 'forced', 'forcing', 'enforce' are derived from the same base word, in Oromo the term is dominantly used for two concepts 'force' and derived term *humnaa?uu* 'becoming forceful'. The use of derivatives for conceptually related terms is vital since it makes understanding easy. Once the learner identified the base word, the added affixes guide him or her to conceptualize what the derived terms mean. Furthermore, According to Kageura (2002) different affixes are very important to establish conceptual relationship among terms in a domain. In some terms,

<sup>18</sup> For instance, accelerate is *sardamuu* or *dabaluu*, accelerator is *meešaa sardamsiisuu makiinaa*. Similarly, force is *humna* and forceful is *□abaa* or *ćimaa* and enforce is *dirkiisiisuu*.

affixes of other languages are received though corresponding indigenous affixes in the target language can play the same role. For instance, in *ʔelektiroomaagneeti-zimii* (8/49) 'electromagnetism', though it is possible to add suffix */-ummaa/* to *ʔelektiroomaagneetii* to express the concept 'electromagnetism' *ʔelektiroomaagneet-ummaa*, the suffix */-ism/* is borrowed. However, both */-ummaa/* and */-ism/* are abstract nominal suffixes. Regarding this, Plag (2002, p.109) assures that the suffix */-ism/* is abstract nominal suffix. It is added to concrete nouns to form abstract nouns. Similar problem can be identified in *seera maagneeti-zimii* (7/05) 'law of magnetism' the suffix */-ism/* is unnecessarily borrowed from English though the Oromo equivalent can be added to the base word to form *seera maagneet-ummaa*. In some cases, derived terms are not able to express the intended concept. For instance, in *boća sirn-aawaa* (7/15) 'regular shape', the term *sirna* 'system' conceptually expresses 'system' as in *sirna waalt-awaa* 'standardized system'. However, in this instance, it is used to mean 'regular shape' though the accurate meaning of expression seems 'system shape'. As science language should be precise, conceptual difference between 'system' and 'regular' should be clearly revealed.

In some cases, unnecessary suffixes are added to the base term. For instance, in *beek-umsa falaasam-ummaa* (7/4), the suffix */-ummaa/* has only confusing role since the whole term means 'knowledge of philosophy' which has no meaning. The confusion arises from using suffix */-ummaa/*. This suffix is abstract nominal suffix which is added to concrete nouns. In contrary, it is added to abstract noun- philosophy in this instance. The anticipated concept can be expressed by *beek-umsa falaasam-aa* 'knowledge of philosophy'. There is no need of adding the suffix */-ummaa/*. Confusion in using the suffix */-ummaa/* is clearly observable in Oromo physics terms (full account of terms that have derivation problems are included in appendix D4).

Analyses of the above terms are evidences that potential derivations of terms that Draskau (1985) and Kageura (2002) have indicated are not critically considered in development of Oromo physics terms. Similarly, Takkele's (2000) indication that the coined term should be used for derivation of other terms seems to be missing.

#### 4.1.1.3 The Principle of Borrowing

This principle claims that the morphophonemic structure of borrowed term should be modified into the structure of an actual or possible word of the target language. In other words, the linguistic features of borrowed term should fit into the linguistic environment of the target language. A greatest number of Oromo physics terms in students' textbooks are borrowed terms (see table 1). The borrowed terms in the language can be divided into loan translation and simply borrowing. Terms such as *humna morm-ii xijaaj-oo* (8/101) 'normal reaction force', *kuf-aati walabaa-waa* (7/4) 'free falling' are examples of loan translation. Though many of the terms are borrowed according to the phonological and morphological rules of the language, there are terms that do not fit into the rules of the target language.

In the analysis of both grade seven and eight students' physics textbooks, the researcher has recognized that these problems are prevailing. For instance, in *cararaa* (7/120) 'beam of light', it seems that the term *cararaa* comes from Amharic *carar*. Thus, the possible modification after borrowing is the conversion of mid central vowels /ə/ to low central vowel /a/ as Oromo lacks this central middle vowel. Furthermore, as Oromo always takes vowel at the end of the word, it should add vowel at the end. Nonetheless, the final vowel should be short /a/ rather than long /aa/. Thus, the appropriate term is *carara* not *cararaa*.

Phonological problems are also observable in terms like *kaarentii* (8/15), 'current or 'kʌrənt'. When the English term 'current' is introduced to Oromo, the English mid central vowel /ʌ/ is possibly changed to short Oromo low central vowel /a/ rather than long vowel /aa/. The change is due to the fact that Oromo lacks this mid central vowel. The same is true for vowel /ə/. The possible change is from /ə/ to /a/ for the same reason. Therefore, *karantii* is more plausible than *kaarentii*. Similar phonological problem can be identified in another borrowed term *šuboo* (8/27) 'wire'. This term is borrowed from Amharic term *šibo* 'wire'. The possible phonological modification during borrowing is the conversion of high central vowel /i/ which does not exist in Oromo to high front vowel /i/. Therefore, phonologically acceptable term is *šiboo* rather than *šuboo*. As far as the knowledge of the researcher is concerned, it is *šiboo* not *šuboo* which is being used among the speakers of

the language. This principle further stresses that foreign terms which are accepted by the speakers of the language should be taken as they are rather than coining new terms. Similarly, for concepts which can be expressed by indigenous terms, additional term should not be borrowed to express the same concept (Amsalu, 1986 & Christopher, 2002).

However, there are terms that are translated for no reason in Oromo physics terms. For instance, the term *yunivarasii* (8/82) is equivalent with the English term 'universe'. This term is being used in students' textbooks. Nonetheless, the term is borrowed for nothing as the term *hawaa* 'universe' has already been in the language and obviously known among many speakers of the language. In similar way, though the term *taa?-umsa lafaa* 'geography' has already been used by the speakers and even in many books that the researcher knows, 'geography' is borrowed in students' textbooks and stated as *ji?oograafii* (8/03). The same is true for *balbii ?eleektirikii* (7/62) 'electric bulb' which is borrowed from English. The term *?amboolii* has already been existed in the language being borrowed from Amharic term *?ambol*<sup>19</sup>. Similar observation is possible in *killeensa ?atmoosferii* (7/92) 'atmospheric air'. The term *killeensa naannoo* has already been existed and even used in many science texts that the researcher experienced very well.

The term *paartikil-oota* (8/11) is also unnecessarily borrowed since the term *suudo-wwan* 'particles' can exactly express the concept. Almost similar observation is possible in *bilbila gurratti qabatan* 'telephone' (8/45). There are three terms that are being used to express the same concept: *bilbila*, *silki* and *telefoona*. The principle recommends using one of this terms rather than developing new one. The researcher believes that *telefoona* is better since *silki* is known only in some dialects of the language and *bilbila* is being used for 'bell' as well.

Depending on the above facts, it is plausible to suggest that the claim of Amsalu (1986) that terms already exist should not be borrowed seems to be neglected in Oromo physics

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<sup>19</sup> The term '*?ampole*' may not be originally Amharic term; most possibly Amharic borrowed it from other languages. However, it appears to be that the term entered to Oromo from Amharic following the prevalence of using electric light.

terms' development. Similar to claim of Christopher (2002), some borrowed terms are not able to express source language concepts in the target language. All these evidences are good indicators that a number of Oromo physics terms are not borrowed according to the rules of the language. There are also terms which are unnecessarily borrowed in contrary to recommendation of Amsalu (1986), Massamba (1986), Takkele (2000) and Yule (2006) (further examples are on Appendix D2).

#### **4.1.2 Evaluation of Physics Terms from Conceptual Perspectives**

In this section, terms that were collected from grade seven and eight students' physics textbooks are evaluated in terms of principles adopted for conceptual analysis.

##### **4.1.2.1 The Principles of Motivation**

According to Draskau (1985, p.114), this principle asserts that term formation should be logical and self explanatory. It claims that terms should remain unmodified though the concept might have undergone radical changes through time; the form of the term should remain unchanged to keep pace with technological development. He asserts, "The march of progress should show that originally well motivated term may loss its motivation but the form remains uniform."

Accordingly, the motivation of a term must also maintain relationship with that of other terms within the same system. Related terms should have related motivation for their development. Thus, three things are indispensable as far as this principle is concerned. First, coining term should involve consideration of semantic motivation; the coining task should be grounded on some semantic reasons. Second, the form of the term should preserve uniformity regardless of whatever happens to the motivation. Third, related terms should have related motivations.

When physics terms are viewed given these three filtering points, there are terms that fail to fulfill the right terminological requirement that the principle inquires. Some terms are arbitrarily developed only since the new concept should be designated by linguistic symbols. They are coined without any semantic reasons. We can consider terms such as

*fi'ir-uu* 'flew', (7/120). This term is strange for the people I consulted, for dictionaries and for the researcher as well. *fi'ir-uu* 'flew' is given as an equivalent term with 'flew' in students' physics textbooks, glossary part. However, 'flew' is the past tense of fly. It can be represented by very known expressions such as *barar-te* (f) or *barar-e* (m) and *balalite* (f) or *balalii?e* (m) in some dialects.

To illustrate the significance of presence of motivation among conceptually related terms, it is crucial to consider the relation between *hittis-oo* (8/101) 'resister', *hittis-ummaa* (8/101) 'resistivity', and *hittis-a* (8/23) 'resistance'. These three terms are related both conceptually and linguistically as knowing one of these terms can help to know the remaining terms. These terms are also semantically well motivated since three of them have relation with the concept 'hinder'. This is because all the three concepts do have relation with 'hindering the flow of electric current.'

However, there are terms that have neither motivation relation nor consistency of form. If terms like *bilbila* (7/2) 'bell or telephone', *mobaayila* 'mobile phone' and *telefoona* (7/2) 'telephone' are examined, it is not difficult to observe the absence of change of motivation and lack of motivation relationship. The term *bilbila* was originally used in the language to express the concept of 'bell' as bell in the school, church and some work places. It seems that this concept directly extended to 'telephone' when the instrument was introduced possibly because 'telephone' like 'bell' produces ringing sounds. May be this is why telephone is expressed as *bilbila gurrati qabatan* (8/45), literally, 'bell which is attachable to the ear' in the students' physics textbooks possibly to indicate its difference from 'bell' which is heard in the far distance.

The problem here is that 'mobile' is *moobaayila* in the language. There is no any motivational relation between the term *bilbila* 'telephone' and *moobaayila* 'mobile phone'. However, the motivational relations between these two terms and the significance of their relation are clearly observable in English. 'Telephone' and 'mobile phone' are highly related since 'mobile phone' is a phone which is portable in contrast to 'telephone' which is stationary. The consistency of form which the principle of motivation claims is also present

in English in contrary to Oromo *bilbila* and *moobaayila*. The term 'phone' is present in both 'mobile phone' and 'telephone' in English. Such conceptual and form integrity is required in the domain to ease understanding and provide concept web within the domain.

The principle of motivation also asserts that semantic motivation of a term should be changed with technological change. Otherwise, the former motivation may not express the contemporary technological concepts. If we consider terms such as *sibiila* (7/5) 'iron or metal' and *hadiida* (7/120) 'steel', we can clearly observe the confusion arises due to lack of change of motivation following technological advancement. The term *sibiila* originally and even today used to mean 'metal' which is collective name of many metallic substances such as steel, gold, silver and others. Among Oromo speaking community all metallic substances are *sibiila*. However, now precise communication in science necessitates the distinction between 'metal' and 'iron'. Consequently, *sibiila* has maintained its meaning 'metal' in students' physics textbooks while iron which was formerly considered as metal received new name- *ገaayranii* 'iron'.

Similarly, *hadiida* 'railway' has been used for 'steel' probably due to the fact that *hadiida* 'railway' was originally made from steel. Now days, however, 'steel' and 'railway' is not the same. Possibly, steel is mere one component which is used in the construction of 'railway'. Therefore, the researcher recommends using the term *ገistiilii* which is borrowed from English-steel than *hadiida*. The examples illustrate that lack of motivation has resulted in coining of terms that do not cope with technological changes. The meaning of *hadiida*, therefore, continued to be used both for 'railway' and 'steel' without any altering in semantic motivation. The existing technological changes that brought distinction between steel and railway is absent in the realm of Oromo.

Though iron and metals are distinguished in students' physics textbooks, many dictionaries provide similar definitions for both metal and iron. For instance, in Elele English-Oromo-Dictionary 'iron' is equivalent with *sibila* 'metal'(459). In the same way 'metal' is also *sibila* (579) which makes both concepts exactly the same. Similarly, in Harmony English-Oromo dictionary, iron is *biyyoo sibilaa* (290) 'soil of metal' and 'metal' is *sibla* (331). This also

doesn't make any distinction between metal and iron rather it creates confusion since iron is considered as 'metal in powder form'. Similarly, steel is defined as *sibila*  $\square$ *abaa* 'strong metal' in Elele English-Oromo Dictionary (918) but it is *sibila* 'metal' in Hamony English-Oromo Dictionary (444) which makes no distinction between metal and steel. However, In Oxford Advanced Learner's Dictionary (734), 'metal' is defined as a type of solid mineral substance such as tin, gold copper and so forth whereas iron is defined as very hard metal used to make steel (631).

Similar report is possible with the term *konkolaataa* (7/01) 'car'. The accurate meaning of the term is 'vehicle'. The term is onomatopoeic word which is derived from the sound of any rolling object. Any rolling object including cart, bicycle, car and others can be *konkolaataa*. In students' physics textbooks the term is specified to car, of course many speakers of the language know that *konkolaataa* is car. Though the motivation of the term is narrowed from vehicle to car, there is no term that represents the original concept-vehicle. As a result, both vehicle and car are *konkolaataa* in Oromo. Because of this, dictionaries provide similar meaning for both concepts. For instance Elelee Dictionary (1052) and Harmony dictionary (489) do not make distinction between the car and vehicle. Therefore, it is observable that there are terms that lack the motivation which Draskau (1985) and Sagar (1990) claim to be attained in term development (see appendix D6).

#### **4.1.2.2 Principles of Conceptual Transparency**

This principle<sup>20</sup> contends that any term creation mechanism should produce terms whose meanings are predictable. Terms should follow familiar and established pattern of meaning which are in use in the language. The principle contends that terms should not be opaque for they lack connection with any meaningful structure of a language. Lack of transparency can be the cause for the terms to be rejected by the users. This principle is similar with principle of authenticity except it focuses on concept rather than linguistic features. Lack of transparency often emanates from lack of effective utilization of methods of term formations described in 2.2.3 (Takkele, 2000).

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<sup>20</sup> See 2.2.6.2.2 for further explanation on principle of conceptual transparency

Viewed from this point of view, some of the terms in students' physics textbooks are found to be conceptually confusing. They are confusing as they are developed without due consideration of morpho-phonemic natures of the language. For instance, *sarara humna maagnet-ummaa* (8/101) is assumed to be equivalent with 'magnetic force of line'. However, the two concepts are different. The suffix /-ummaa/ in *maagneet-umaa* is abstract nominal suffix which is equivalent with English /-ism/. Thus, the compound term *sarara humna maagnet-ummaa* is equivalent with 'magnetism line of force' which is different from 'magnetic line of force'. Similarly, the compound term *taatee maagnet-ummaa* (8/102) has been considered conceptually equal with 'magnetic effect'. Like *sarara humna maagnet-ummaa*, the term doesn't express the intended concept rather it means 'magnetism effect'. It seems that the confusion arises from inappropriate utilization of suffix /-ummaa/.

Like wise, the term *jijirt-oo dambalii guutuu* (8/101) is given as equivalent with 'full-wave rectifier'. In this compound term, however, *jijirt-oo* is not conceptually equal with 'rectifier' for /-oo/ in *jijirt-oo* is resultant nominal suffix while English suffix /-er/ in 'rectifier' is agent nominal suffix. There are also terms which are confusing since they lack precise meaning. Some terms are opaque since their sources and their methods of development are unknown. For instance, the meaning of *sisinne* 'temporary' is unknown by many users. Nonetheless, this term can be substituted by other terms which the students understand easily. *guyyee* or *har?umee* 'temporary' can be forwarded in this regard. There are many such examples in Oromo physics terms (appendix D7 can be referred). As a result, it seems that the predictability of terms forwarded by Sagar (1990) and Takkele (2000) has not been fully considered in development of these terms.

#### 4.1.2.3 The Principles of Synonyms and Polysemy

This principle<sup>21</sup> rejects the use of synonymous terms within particular domain. It contends that both synonymy and polysemy cause confusion and create false impression that more than one concept exists. The principle favors 'one concept-one term' correlation and recommends the avoidance of both representation of one concept by many terms and

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<sup>21</sup> see 2.2.6.2.3 for more explanation on principle of synonymy and polysemy.

signification of many concepts by a term. It states that there should be one to one correspondence between a term and the concept it designates.

The presence of synonymous and polysemous terms are the core challenges that call for urgent revision as far as physics terms in students textbooks are concerned. In the textbooks under consideration, there are many such terms. It seems that there are two sources that are contributing to emergence of these problems. The first one is simultaneous coining and borrowing of terms. These resulted in instantaneous use of both Oromo and borrowed terms. Pair of terms such as *marsaa šuboo* (8/45) 'coil' and *kooyilii* (8/45) 'coil', *hamara* (8/72) 'violet' and *vaayooletii* (8/73) 'violate', *yunivarsii* (8/82) 'universe' *hawaa* (8/82) 'universe' again *samii* (8/86) 'universe' , *tiraaktarii* (7/82) 'tractor' *konkolaataa kotisaa* (7/82) 'tractor' are illustrative evidences. Though it is true that providing equivalent English terms help students for their future education, insensately using both Oromo and English terms can confuse students. According to principle of synonymy, because such different forms of the same concept confuse students, they should be avoided.

Another source of problem which results in synonymy is utilization of terms of the same concept which are found in different dialects rather than selecting one of them. For instance, *šaddeessa* (8/83), *baatii* (8/95), *garaabaa* (8/95), *□i?a* (8/83) are terms of the same concept-moon. Equally, *bikuu* (8/100) and *safaruu* (7/6) are the same thing-measure. These synonymous terms have emerged since a term has been used without examining the presence of the same terms within dialects of the language.

Polysemous terms are also common in Oromo physics terms. For example, in *kat't'aamura* (7/6) 'displacement' and *kat't'aamura* (8/26) 'cross-section', a single term is used to represent two concepts. Similarly, the term *daabbataa* means many things. It means 'stationary' (7/23), 'permanent' (8/9), 'uniform' (7/18) and 'constant' (7/42). *lafa* (7/03) means 'earth or land' , *yaalii* (7/45) is 'exercise or try' and *deebii* (7/43) is ' answer or solution'. In general, one concept-one term notion forwarded by Draskau (1985), Felber (1984) and Takkele (2000) is absent in these terms (See appendix D8 and D9).

#### 4.1.2.4 The Principle of Conceptual Equivalence<sup>22</sup>

As has already been mentioned, in principle, concept of a term in source language and target language should coincide. Conversely, in practice, concept between terms of different language shows different degree of equivalence. Conceptual relation between corresponding terms can be equivalent, partially equivalent and non equivalent. Principle of conceptual equivalence claims that the concepts of terms in source language and that of target language as much as possible should be equivalent (Draskau, 1985 & Felber, 1984). Similarly, Christopher (2002, p.37) warns that the translators should attempt to create the same effect on the target language audience as the original writer created on the source language readership.

With this guideline, we can appraise the degree of equivalence of Oromo physics terms with corresponding terms in English. The analysis shows that some terms are equivalent, some are equivalent only to some extent, and others are not equivalent at all. If we compare *ʔardii lafaa* (7/119) 'continent' and English term 'continent', for instance, we can observe conceptual difference though they are used as if they were similar in students' textbooks. *ardii lafaa* is simply mean 'world of earth' since *ʔardii* is 'world' and *lafa* is 'of earth'. It contains ironic concept as in reality world cannot be part of the earth. Rather it is earth which is a part of the world. Many Oromo dictionaries do not make distinction between world and continent. The researcher would suggest *kaama lafaa* as a better term. We can also consider *diriirs-uu* 'derive' (8/100) which is assumed to be equivalent with 'to derive' or 'derivation'. The exact meaning of *diriirs-uu* is 'to flatten'. This shows the existence of conceptual difference between the two terms. If we compare, *sooččii daandi marfat-aa* (7/24), with 'curvilinear motion', we can also see conceptual mismatch between the two. Conceptual difference arises from suffix /-aa/ in *soočči daandi marfat-aa*.

Analogous observation is possible with *faana kopee* (7/47). It was assumed to be conceptually similar with 'sole of shoe'. However, *faana* is 'print and *faana kopee* is 'footprint'. Therefore, the literal meaning of the expression is 'shoe print' which is quite different from 'sole of shoe'. Correspondingly, *teess-uma* (7/83) is perceived to be

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<sup>22</sup> for further information on conceptual equivalence refer to 2.2.6.2.4

equivalent with 'area'. However, *tess-uma* is surface of something'. Area is *balʔ-ina*. This term is common in many science texts.

Degree of conceptual equivalence can be more illustrated by making comparison between characteristics of corresponding terms. For two terms to be equivalent there should be conceptual match between each corresponding characteristics. For instance, given that term 'A' contains characteristics a1, a2, a3, a4 ...and so on, and term 'B' contains characteristics b1, b2, b3, b4 ...and so forth, then each characteristics in 'A' should be conceptually equivalent with the corresponding characteristics in 'B'. Suppose that 'A' is *diriirs-uu* 'flatten' and 'B' is English term 'derive'. Then, conceptual equivalence between the two terms can be illustrated as presented in Table 2 In this case, the definitions of both 'to derive' and 'flatten' are taken from Oxford Dictionary page 445 and 313 respectively.

	A		B	comparison	equivalence
a1	involves spreading	b1	involves variety increment	a1 # b1	<b>not equivalent</b>
a2	occupies surface	b2	may not occupy surface	a2 # b2	
a3	the progress results in surface increase	b3	the progress may not result in surface increase	a3 # b3	
a4	either happen or made by some body	b4	either happen or made by some body	a4 = b4	
a5	the size of an item increases	b5	a single item obtains many similar items	a5 # b5	
a6	the spreading process happens on one level in predictable position	b6	nature of the level is unpredictable	a6 # b6	

**Table 2 Conceptual mismatch between corresponding Terms**

It is apparent from the table that among six characteristics derived from definitions of corresponding terms, only one of them shows equivalence. This in turn justifies that the two terms are not equivalent. All explanations given above and comparison in Table 2 substantiate the suggestion of Felber (1984) which points out that concept equivalence is

not often taken in to consideration in developing specialized vocabularies of many languages. The examples are also good evidences for the absence of Christopher's (2002, p.35) claim, "Coincidence of conceptual fields is likely to exist in taxonomic science." He further points out that the dominant problem with term is finding the right equivalent as in theory there is one equivalent. In the same way, Sagar (1990) indicated that in various documents, various paraphrases of the same term often appear.

#### 4.1.2.5 The Principle of Compounding

There are four kinds of fusion of concepts as presented above. The first one is determination in which the genus determines the other (the species) and increases the number of its characteristics. Here, the new concept becomes subordinate concept. The second one is conjunction in which the sum of predication or characteristics of constituent concepts forms the fusion of intention<sup>23</sup> and forms subordinate concept common for both constituents. It is characterized by 'and'. The third is disjunction which is the sum of extension<sup>24</sup> of constituent concepts. The constituent concepts fuse in to one generic or subordinate concept. It is characterized by 'or'. The final is integration in which various individual objects unite into one (Christopher, 2002, p.37 & Draskau, 1985).

According to these scholars, in forming compound terms both linguistic and conceptual features of constituent terms should be critically examined. As can be observed from Table 1, among 71 possible combinations of compound terms, 33 are hybrids among which 32 are Oromo- English hybrids and one is Amharic-Oromo hybrid. The remaining 38 are Oromo-Oromo combinations. In Oromo noun-noun and noun-adjective combination is possible. In both hybrid and none hybrid types of combinations, the resultant terms contains various constituents. Many compound terms contain two constituents, others three constituents and a few of them contain more than three constituents.

For instance, *hima walkit'aa* (8/101) 'equation' is composed of two constituents; noun *hima* 'sentence', and adjective *walkit'a* 'equal'. Therefore, this compound term has

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<sup>23</sup> Intention is the aggregate of all characteristics which constitute a concept (Draskau 1985).

<sup>24</sup> Extension is the aggregate of all imaginable species of concept considered separately (Draskau 1985).

meaning which is equivalent with 'equal sentence'. Conceptual mismatch between *hima walkit'aa* and 'equation' is clearly observable since 'equal sentence' doesn't mean 'equation'. Equation has nothing to do with sentence. This mismatch overtly occurred as the compounded elements cannot produce the intended concept. The researcher would recommend deriving the term 'equation' from the base verb *walkit'-a* 'equate' by derivation than using *hima walkit'aa*. Similar problem is observable in *balʔaččuu balʔinaa* (7/119) 'surface expansion'. The term *balʔaččuu* is equal with English 'expansion'. *balʔinaa* is 'of wideness' or 'of area', and the combination of the two forms compound word which is 'expansion of area'. Any educated speaker of the language can easily understand that there is no concept of 'surface' here.

Some of the compound terms contain three constituents as mentioned above. For instance, *guula harkis-a lafaa* 'gravity' (8/101) is composed of nouns *guula* 'acceleration', *harkisa* 'attraction' and *lafaa* 'of earth'. Such combinations are common in Oromo. However, the concept these combinations of terms presents is highly restrictive to express the concept intended, 'gravity'. The concept 'gravity' is not exactly equal with 'the attraction of the earth' since gravity also exists on other planets. *humna wal dahinsaa* (8/101) 'force of collision' is another example that involves combination of more than two terms. The terms are composed of noun *humna* 'force', preposition *wal* 'against' and noun *dahinsaa* 'of hitting' which collectively becomes 'force of collision'. The researcher thinks that this term is appropriate. *booća siirna-awaa hin taʔiin* (7/119) 'irregular shape' *hittis-oo kodii biffaa* (8/101) 'color coding resistor' and, *soččii daandii marfa-taa* (7/65) 'curvilinear motion' are some among other many examples of compound terms that contain more than two constituents.

In some compound terms, phonological problems of constituent terms contribute to production of meaning which is different from intended one. For instance, *ʔulee biraasi* (8/13) is used in the physics textbooks to mean 'stick of brass' though the meaning of the compound term in the textbooks is 'stick which is brass'. This conceptual difference emanates from the fact that most often long vowels show genitives when they appear at

the end of the compound terms in Oromo. Thus, the right way to spell the term is *ʔulee biraasii*. There are many such terms as can be referred from Appendix D5.

It is also possible to provide many terms that resulted in production of unintended concepts. For instance, in *naannoo irra galaanaa* (7/92) 'above sea level', the combination is used to express 'above sea level' though it does not provide this kind of meaning. The literal meaning of the term is 'area on the sea' as *irra* is 'on' not 'above' in the language. Similarly, in *saffisa sagalee* (7/121) 'speed of sound', *saffisa* is 'speed' and *sagalee* is 'sound' which collectively form 'speed of sound'. The constituents are *saffisa* 'speed' and *sagalee* 'sound' which are independent concepts. However, after composition, 'speed' becomes subordinate (species) concept as it is possessed by sound (genus). Then, the total concept 'speed of sound' is also subordinate as it is component of the general concept 'speed'. Therefore, the combination type is determination. *saffisa*, which is the independent concept (genus) increased its predicates<sup>25</sup> as the characteristics 'speed of sound' is added to it.

Conceptual difference between the two terms is obvious. *saffisa sagalee* is 'speed of sound' while *sagalee* is 'sound'. Conversely, *saffisa sagalee* 'speed of sound' is written in students' physics textbooks as if it were equivalent with *sagalee* 'sound'. Similar concept relation is observable in *ʔulee meetiraa* (7/ 8) 'meter'. The meaning of *ʔulee meetiraa* is equivalent with 'stick of meter'. Initially, both *ʔulee* 'stick' and *meetira* 'meter' were independent concepts. After combination, nonetheless, *ʔulee* becomes dependent characteristics of *meetira*. As a result, *meetira* has increased its characteristics since there was no concept of *ʔulee* before combination and becomes possessor of *ʔulee* after composition. It is clear that *ʔulee metraa* and *meetira* are conceptually different. In students textbooks *ʔulee metraa* is the lengthy part of the meter. Probably the term is developed to differentiate this part of the meter from metric scales on the meter. The situation is not different with *ʔulee maagneetii* (8/2) 'magnate rod' and *ʔelektirikii daabbataa* (8/9) 'permanent electric'.

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<sup>25</sup> According to Draskau (1985), predicate is synonymous with characteristics.

Combination of terms can be conjunction of concepts which results in formation of subordinate concept common to both constituents. Here, the resulting concept contains the sum of predication of constituent concepts. For instance, in *ʔaayirani* (7/76) 'iron' and *caarbonii* (7/65) 'carbon', the constituents form the compound *hadiida* 'steel'<sup>26</sup>. The characteristics of the compound term is the sum total of predicates in each constituent term. Combination of terms can also be disjunction in which the sum of extension of constituent concepts fuses into one common generic or subordinate concept. It is characterized by 'or'. The best example in Oromo is *sibiila* (7/43) 'metal' which contains different combination of concepts including *warkée* 'gold', *kopparii* 'copper' and other metallic substances. It should be noted that disjunction is combination of extension of concepts while conjunction is combination of characteristics or predicates. Thus, 'metal' contains combination of concepts while 'steel' contains combination of characteristics.

Integration of concept is also possible in combination of terms. In this case, various individual things unite into one. For instance, in *buʔaa baʔii* 'ups and down' the two concepts, ups and downs, are integrated but not composed together. From the above illustration, it is observable that there are compound terms which do not fulfill the linguistic and conceptual requirements of combinations that should exist as stated by Draskau (1985), Felber (1984), Kegeura (2002) and Temsegen (1993). For further example see appendix D3.

### **4.1.3 Evaluation of Presentation of Terms across Textbooks**

Here are presented problems of orthographic inconsistency and definitions of terms in students' physics textbooks.

#### **4.1.3.1 Orthographic Consistency**

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<sup>26</sup> Note that According to Draskau (1985) in combination of concepts, there are cases where the constituent concepts may not linguistically appear in resultant concept.

This principle stresses that a term should not manifest orthographic and phonemic<sup>27</sup> variations. It should be spelt only in one possible way (Draskau, 1985). The principle asserts that orthographic variation can mislead term understanding and results in confusion. Such confusion is one huge area of problems as far as physics terms in students' textbooks are concerned.

For instance, 'satellites' is spelled in two different ways across the texts *saatalaayitoota* (7/3) and *satalaayitoota* (8/17), 'diameter' similarly has two manifestation *diyaameetira* (7/8) and *diyaameetrii* (7/7), 'temperature' appeared as *teempirečara* (8/74) and *teempireeačarii* (8/74). Likewise, the term 'given' is presented in two diverse forms across the texts: *kennamaa* (7/30) and *kenneman* (7/42). There is similar case with 'acceleration' for it appeared as *guula* (7/6), *guuala* (7/120). The term 'planets' appeared as *pilaaneetoota* (8/85), *pilaanetota* (7/3) and *pilaneetoota* (7/24) across the students physics textbooks.

The cause of such orthographic inconsistency in term presentation may be due to many factors which are not a part of this study. Nonetheless, in the above examples carelessness and phonological nature of the language can be the factors. For instance, the variation between *guula* (7/6) and *guuala* (7/120) can be simply carelessness. However, in *saatalaayitoota* (7/3) and *satalaayitoota* the cause can be difficulty of identifying long vowels from short vowels. As stated under 2.2.3.1 length is phonemic in the language (for further example see Appendix D5).

As the above examples illustrate, there are numerous inconsistencies in orthographic representation of terms within and across the texts. These can lead to great confusion as students may perceive that the terms are different only for they are written in different ways. Such form variation can lead the students to the conclusion that the two terms are different. Similar orthographic inconsistency was also observed by Aragaw (2009, p.67). He identified that there were difficulty of orthography in Amharic natural science terms. In

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<sup>27</sup> Since Oromo is phonemic language orthographic inconsistency can be considered as phonological inconstancy.

general, recommendation of Draskau (1985) that terms should orthographically be consistent seems susceptible in Oromo physics terms presentation. Regarding impacts of such form inconsistency, Sagar (1990) observes that even experienced users, who can be described as domain experts, may not remember the exact form of a term and use it in the same way. Thus, he recommends that care should be given to the form of terms while using them.

#### 4.1.3.2 Definiendum-Definiens Equivalence<sup>28</sup>

Draskau (1985) and Felber (1984) contend that there should always be equivalence between definiendum and definiens. The type of definitions given to a term can be intention, extension or contextual definition. There are four major defective type of definition of terms which should be avoided: incomplete definition (some part of the definition is missing), excessively restrictive definition (definition is formally correct but the characteristics are too restrictive), excessively broad definition (extra characteristics are added to the definition) and circular definition (repetition of the same or synonymous terms plus distinctive characteristics). Generally, there are two types of definitions of terms: in-text definition and definition of terms outside the text. The focus here is only in-text definition of terms.

When we approach Oromo physics terms with these guideline, we may find many of the definitions relevant. However, there are some definitions that need revision. For instance, 'electric field' is defined as follow: (8/11)

*dirree-n ?elektirikii sararaa-wwan yaadaa-n humn-i ?elektrikii kabuu da field -Nom electric.Gen line -pl idea -with force-Nom electric.Gen has cop 'Electric field is lines that electric force ideally contains'.*

It is not difficult to observe that the definition given to this term is quite different from the right definition of the term. The same term is defined in A Dictionary of Science (17) as "electric field is the region around the charged body where the electric force is felt". At

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<sup>28</sup> For detail elaboration about definiendum and definiens relationship Felber (1984) and Draskau (1985) can be referred.

least two drawbacks are visible in the above Oromo definition given for 'electric field'. First, the definition contains odd characteristic- *yaadaan* 'ideal' which means that the presence of electric force is only ideal. Second, the term *sararaawwan* 'lines' is used in terms of 'region' though they are quite different. In the domain, magnetic lines and magnetic fields are quite distinct concepts. Therefore, this definition is excessively broad. It is excessively broad since it contains extra characteristics 'ideal' and 'lines'.

In some cases, definitions given for certain expressions provide information which is very far from what the term should have really expressed. This is due to the fact that definiens often contains neither the genus nor distinctive characteristics of the definiendum. For instance, the definition of *konvenšinaalii* 'conventional' was presented as (8/06):

*konvenšin-aalii-n waan yaadaa-n malee ?uumaa-n hin-jir-n-ee da*  
*convention-Adj-Nom thing idea-with only creator-with Neg-exis-ne-T-Pf Cop*  
*'Conventional is something that only ideally exists not in reality'*

This means that 'conventional means something that ideally exists but not in reality'. Similar term is defined as "conventional is what is done or considered acceptable by society in general", in Oxford Dictionary (254). It is not too difficult to see that 'what society accepts in general' and 'something that only ideally exist' are not identical. Some definitions of terms provide confusing notions; false definition for the learners. For instance, in (7/15)

*rukkin-ni hirama hangaa fi kabee wanta tokko-ti*  
*dense-Nom division mass and volume thing one-Cop*  
*'Density is the division of mass and volume of some thing'*

The literal meaning of the definition is 'density is the division of mass and volume of something'. Nevertheless, what is intended to be said is 'density is the division of mass of something to the volume'. We can see that the two concepts are quite dissimilar.

Problems of definitions have also been raised by other scholars. Christopher (2002, p.34) points out that ideally terms should be defined analytically, fixing their meaning in a

precise way in relation to all other associated terms. Adugna (2009, p.47) similarly observes that concepts expressed by some terms lack precise definitions that distinguish them from others terms. Therefore, definiendum-definiens correspondence that Draskau (1985), Felber (1984) and Thaller (1986) recommend are not fully considered in provision of Oromo physics terms in students' physics textbooks.

## **4.2 Presentation and Analysis of Respondents' Response**

This section deals with data that are obtained from grade seven and eight students, physics teachers and scholars that have been participating in the term development. Information obtained from respondents' questionnaire and interview are presented and analyzed as follow.

### **4.2.1 Presentation and Analysis of Data Obtained from Questionnaires**

The information obtained from students' and teachers' questionnaire is presented by dividing them in to three main conceptual categories. The categorization is made depending on the focus of the items: linguistic appropriateness of terms, conceptual appropriateness of terms and term usage.

The presentation, however, starts with report of students' and teachers' personal information. As stated in sampling techniques in 3.3 of chapter three, in the three schools under consideration, 15% of the total students were considered for questionnaires. Accordingly, in Ciroo No.1 Primary School there were total of 325 grade seven and grade eight students. Among them, 175 are grade seven students while 150 are grade eight students. Therefore, 26 students from grade seven which accounts for the total of 15% were considered. Similarly, 23 students which are again 15% of students in grade eight were sampled. There are four similar second cycle elementary schools in Ciroo town only and the figure presented here represents only Ciroo No.1 Elementary School which is considered as a sample in the study.

In Debesso Primary School, there were total of 470 grade seven and grade eight students. Among them, 230 are grade seven students while 240 are grade eight students. Therefore,

from grade seven 35 students which account for 15% of the total were considered. In same way 36 students which account for the total of 15% were selected from grade eight. Similarly, in Hirna No.1 Primary School, there are total 365 grade seven and grade eight students. Among them, 170 are grade seven students while 185 are grade eight students. According to the procedure, 26 students are taken from grade seven which accounts for 15% of the total. In the same way, 28 students were considered from grade eight which accounts for 15% of the total. There are three second cycle primary schools in Hirna town alone. However, the figure here represents only Hirna No.1 Elementary School.

After identifying the samples through these procedures, the questionnaires were distributed to the sampled students. However, there were some respondents that did not return the questionnaires. The figures of the returned and missed questionnaires are presented as follow.

No.	Name of the School	Quest. Distributed	Quest. Returned	Quest. Missed
1	Debbesso	71	65	6
2	Ciroo	49	49	00
3	Hirna	54	54	00
Total		<b>174</b>	<b>168</b>	<b>6</b>

**Table 3 Students involved in questionnaire**

As the above table indicates, among the total of 174 candidates involved in the questionnaires, 168 students responded and returned the questionnaires while six respondents didn't return the questionnaire.

Regarding physics teachers, as the numbers of physics teachers in the three schools were not enough to respond to the questionnaires, the questionnaires were distributed for physics teachers in 14 schools (see appendix A). As a result, thirty teachers from fourteen schools filled the questionnaires and returned. Personal information of both students and teachers is presented as follow.

students	Age				Sex		Grade			
	<10	10-15	15-20	>20	m	f	seven	eight		
	0	121	43	4	102	66	84	84		
Total	168									
Teachers	Years of Teaching experience					Sex		Education level		
	< 5	5-10	10-15	15-20	>20	M	F	Certificate	Diploma	Degree
	6	10	6	6	2	28	2	0	30	0
Total	30									

**Table 4: Students' and teachers' personal information**

As the above table depicts, among 168 students that responded to the questionnaires, 121 of them are between 10-15 years, 43 of them are between 15-20 years and 4 of them are above 20. The figure also shows that the majority of the respondents are males (102) while females are 66. Male to female ratio is around 1.5:1. The numbers of respondents in both grade seven and eight are incidentally equal: 84 and 84 respectively.

As can be observed from the table, among thirty physics teachers included in the study, only two are females while the remaining 28 are males. All teachers are diploma holders. Only six of them have working experience of less than five years. Ten of them have between 5 to 10 years work experiences, six between 10 and 15, other six ranges from 15-20 and the remaining two have more than 20 years work experience.

#### **4.2.1.1 Respondents' Responses on Linguistic Appropriateness of Terms**

The following are presentation and analysis of information that were collected from both teachers and students regarding linguistic appropriateness of terms. Among 18 items

included in the questionnaire, item no.1, 2, 3 and 4 aimed at gathering information regarding linguistic appropriateness of terms. Item 1 is concerning pronunciation of terms. Regarding this, many of the respondents indicated that the pronunciation of the terms has medium level of difficulty as presented in Table 5.

I.1 Pronouncing terms in your (your students) physics textbook is?		SR		TR	
		F	%	F	%
A	very easy	25	14.88	00	00
B	easy	23	13.69	02	6.66
C	medium	69	41.07	18	60
D	difficult	51	30.36	10	33.33
E	Very difficult	0	00	00	00
	Total	168	100	30	100

**Table 5 Level of pronunciation difficulty of terms**

Table 5 indicates that 25 (14.88%) of the students think that pronouncing terms in their physics textbooks is very simple while 23 (13.69%) of them feel that the terms are simple to pronounce. Nevertheless, many of them, 69 (41.07%), responded that the terms have medium level of pronunciation difficulty. 51 (30.36%) of the total students agree that the terms are difficult to pronounce. As the table depicts students and teachers have almost similar perception regarding difficulty level of pronunciation of these terms. 18 (60%) of the teachers reported that the terms have medium level of pronunciation difficulty for their students while 02 (6.66%) of the respondents reported that the terms are easy for their students. 10 (33.33%) of the respondents reported that the terms are difficult. None of the teachers responded that the terms are very simple. From the over all figures, it can be concluded that there are physics terms that have pronunciation problems, and these pronunciation problems are posing average difficulty on the learners.

The causes for difficulty of pronunciation of terms should also be addressed. Item 2 is designed for this purpose. Various possible causes were provided for the respondents and their responses are presented as follow.

I.2	If your choice for question No.1 is C, D or E, why do you think that they are difficult to pronounce? (you may circle more than one alternative)	SR			TR		
		F	%	NS	F	%	NT
A	Presence of difficult sounds	37	28.68	120	13	30.23	28
B	strange sound arrangement <sup>29</sup>	39	30.23		21	48.84	
C	presence of long terms	41	31.78		09	20.93	
D	others problems	12	9.30		00	00	
Total		<b>129</b>	<b>100</b>		<b>43</b>	<b>100</b>	

**Table 6 Causes of pronunciation difficulty**

From Table 6, it can be observed that among 120 students who admitted the presence of pronunciation problems, 37 (28.68%) of the students believe that there are sounds which are difficult to pronounce. They responded that there are some strange sounds that are not familiar in the language they speak. 39 (30.23%) of them also indicated that the configurations of sounds within the terms are strange. The students' responses reveal that syllable structure and phoneme distributions within some terms are strange to their linguistic intuition. This problem was also identified by the researcher during text analysis (see Appendix D1). The students also pointed out that there are some long terms which are difficult to utter. 41 (31.78%) of the students admitted the presence of this term problems in their physics textbooks. Lastly, 12 (09.30 %) of the respondents stated other factors such as difficulty of understanding meaning of terms and problems of writing as the basic challenges of the terms.

<sup>29</sup> What arrangement mean was explained for students while distributing questionnaire

As far as teachers' responses are concerned, from 28 teachers who indicated the existence of pronunciation problems, 13 (30.23%) of them agreed that the sounds that the terms contain are factors that make pronouncing physics terms difficult for the students. Yet, 21 (48.84) of the teachers indicated that the way the terms arranged are problems that make pronouncing the terms challenging. Conversely, 09 (20.93%) reported that length of the terms is the factor that makes pronunciation of the terms challenging. From both students' and teachers' responses, it can be generalized that the presence of difficult sounds, strange sound configuration and length of the terms are the major challenges that are making pronunciation of the terms difficult. The presence of these strange sounds may suggest that terms taken from foreign languages are more difficult to pronounce than indigenous terms. Nonetheless, this conclusion contradicts with the finding of Aragaw (2009). He indicates that students pronounce English terms better than Amharic terms. His conclusion seems depending on the fact that many Amharic science terms are derived from Geez and Tigrinya rather than Amharic. Otherwise, it would be strange to conclude that the students pronounce foreign sounds than sounds in their own languages.

Item 3 is regarding preferences of sources of terms. The majority of the students indicated that terms which are developed from Oromo are more easily understandable than terms which are developed from other languages. 85 (50.59%) of the students supported this notion. There were also students who responded that terms borrowed from English are easily understandable as compared to other languages. 51 (30.36%) of the respondents reflected this preference. 29 (17.26%) of the students also responded that terms which are taken from Amharic are easily understandable. The remaining 03 (1.79%) preferred 'others' and provided options such as alternative utilization of Oromo and English terms and using Amharic as medium of instruction.

I.3	Terms of which language do you (your students) think easy to understand?	SR		TR	
		F	%	F	%
A	Oromo	85	50.59	18	60
B	English	51	30.36	10	33.33

C	Amharic	29	17.26	02	6.67
D	others	3	1.79	00	00
Total		168	100	30	100

**Table 7 Term sources and their understandability**

Responses which are similar to students were also obtained from physics teachers. 18 (60%) of the teachers believe that terms developed from Oromo are easily understandable than borrowed terms. 10 (33.33%) of the respondents, nonetheless, indicated that terms borrowed from English are easily understandable to the students. 02 (6.67%) of the teachers preferred Amharic as easily understandable terms. From the figure, it can be argued that respondents believe that using Oromo terms make the subject easily understandable. This justifies Keller's (1972) assertion that technical terms that are not known very well can make a text completely meaningless.

Aragaw (2009), in the same way, reaches on the conclusion that acceptability of terms depends on the terms source language. He further indicates that students and teachers prefer terms taken from English to indigenous terms. However, the figures above seem contradicting with Aragaw's finding since many respondents preferred Oromo terms to English terms. Regardless of Aragaw (2009) finding, the researcher would suggest utilization of terms developed from the local language for two reasons. First, as stated earlier in Calbre (2003), Draskau (1985), Kageura (2002) and Sagar (1990), terms are vocabulary of language for special purposes. Therefore, it seems paradox to recommend that it is better to use English vocabulary to teach in local languages. Second, as presented under 1.1 and 1.2, the rationale of using mother tongue has relation with enhancing understanding. Therefore, using vocabulary of English cannot be solution to solve understanding challenges that emanate from the use of foreign languages as medium of instruction.

Item 4 is regarding linguistic appropriateness of terms in general. As Table 8 displays, many respondents have doubt on the appropriateness of the terms.

I.4	Do you think that Oromo physics terms are linguistically appropriate?	SR		SR	
		F	%	F	%
A	yes	27	16.07	10	33.33
B	yes, to some extent	90	53.57	16	53.33
C	no	45	26.78	04	13.33
* <sup>30</sup>	I have no idea	06	3.57	00	00
	Total	168	100	30	100

**Table 8 Linguistic appropriateness of terms in general**

As Table 8 indicates 90 (53.57%) of the students have reflected that the terms are partially appropriate. Similarly, 45 (26.78%) of them indicated that the terms are not appropriate. Yet, 27 (16.07%), responded that the terms are appropriate. The remaining 06 (3.57%) of the students indicated that they have no idea<sup>31</sup> whether the terms are appropriate or not.

It is easy to see the correspondence between students' and teachers' views on this notion. More than half of the teachers, 16 (53.33%) reported that terms fulfill the requirement in the languages only to some extent. Only 10 (33.33 %) of the teachers agreed that terms are appropriate. The remaining 04 (13.33 %) of them think that the terms are not developed according to their linguistic knowledge of the language. The figures indicate that there are many respondents who do have doubt on linguistic appropriateness of the terms. Aragaw (2009, p.61) makes similar conclusion. He indicates that the majority of students and teachers feel that Amharic natural science terms are not appropriate. He discloses that many of the terms are ill-patterned and ambiguous.

#### **4.2.1.2 Respondents' Responses on Conceptual Appropriateness of Terms**

<sup>30</sup> Six students left item 4 without answer.

<sup>31</sup> Respondents that left the item with out answer were considered that they have no idea.

Here are presented and analyzed data that are related to conceptual appropriateness of terms. In the questionnaire, item 5, 6, 7, 8, and 13 are about concept of terms. Item 5 is regarding level of understandability of terms. As Table 9 demonstrates, there are many students and teachers who agree that some of the terms are not understandable.

I.5	What do you think about level of understandability of the terms?	SR		TR	
		F	%	F	%
A	easily understandable	51	30.36	06	20
B	some are not understandable	90	53.57	20	66.6
C	many of them are not understandable	26	15.48	04	13.33
D	all are not understandable	1	0.60	00	00
Total		168	100	30	100

**Table 9 Terms' level of understandability**

As can be seen from Table 9, 51 (30.36%) of the students responded that physics terms in their physics textbooks are easily understandable. They agreed that there is no problem of understanding these terms. Nevertheless, the majority of the students responded that some of the terms are not understandable. Among the total respondents, 90 (53.57 %) of them reflected such kind of view. 26 (15.48) of the students, however, agreed that many of the terms are not understandable. On the other hand, only one student indicated that all terms are not understandable.

Teachers' responses are not different from students' response in this regard. From the data it can be observed that 06 (20%) of the teachers agreed that these terms are easily understandable to their students. Nevertheless, 20 (66.66%) of the teachers indicated that there are some terms which are not understandable to the students. Only 04 (13.33%) of the respondents indicated that many of the terms are not easily understandable. The whole figure shows that physics terms in students' physics textbooks do have medium level of understandability. This clearly illustrates that there are some problems of understanding as far as these terms are concerned. This result substantiate Ritcher's (1986) assertion that unplanned spread of new terms can pose difficulty of understanding and counter act the right terminological comprehension. Similar conclusion was made by Christopher (2002)

in asserting that in term creation sometimes the model created can lead to semantic confusion. In the same way, Taye (2003) found out that students do not understand Amharic terms in their textbooks.

Item 6 is open ended question which was designed to gather information regarding respondents' choice for item 5. The following question was provided.

Q. Would you please provide reason for your choice of question No. 5?

The respondents provided different reasons. Some students indicated that these terms are difficult since some of them have language problems. They asserted that many of the terms are foreign words; "they are words of English and Greek." There were also students who reported that some terms are conceptually very similar and difficult to identify one from another. They mentioned *saffissa* 'speed' and *ariitii* 'velocity' as instances. Still others suggested that different terms are represented by the same symbol. There were also students who contended that the terms are difficult since many of them are not encountered before these class levels. As their assertion, spelling of some terms is also challenging, for example, *selenooydii* 'solenoid'. Others indicated that many of the Oromo terms are not known by the speakers of west Harargae dialect. They provided *guula* 'acceleration' and *sadaata* 'relativity' as evidences.

Teachers were also asked to provide their own assumption regarding the reasons why physics terms in students' textbooks are not understandable to the students. Some of them mentioned that the terms contain words which are dialects of a few speakers that are not known by the students. Some others indicated that some definitions given for the terms are not clear. They provided examples such as *?aangoo* 'power', *?annisaa* 'energy' and *guula* 'acceleration'.

Item 7 is about level of expression of terms. As Table 10 displays many of the respondents agree that the terms express the concept intended to some degree.

I.7	Do you think that physics terms in your (your students) textbook express what they are intended to express?	SR		TR	
		F	%	F	%
A	yes, they do	68	40.48	08	26.66
B	some of them do not	60	35.71	20	66.66
C	no, they don not	35	20.83	02	6.66
*	I have no idea <sup>32</sup>	05	2.98	00	00
Total		168	100%	30	100

**Table 10 Terms' level of expression**

As can be observed from Table 10, many students responded that the terms are conceptually appropriate. 68 (40.48%) of them indicated that the terms express what they are intended to express. 60 (35.71%) of them agree that the terms are conceptually relevant only to some extent. 35 (20.83%) of the students believe that the terms do not express the concept they are assumed to express. 05 (2.98%) of the total respondents agreed that they have no idea whether the terms express the concept intended or not. Though 68 (41.46%) of the respondents agreed that the terms express what they are intended to express, 60 (35.72%) and 35 (20.83%) of the respondents have doubt on expressiveness of the terms.

Teachers' responses on how much terms express what they are intended to express is similar with that of students. 20 (66.66%) of the teachers indicated that some of the terms do not conceptually express what they are intended to express. 08 (26.66%) of the them however, indicated that the terms express what they are intended to express and the remaining 02 (6.66 %) expressed that the terms do not express what they are intended to

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<sup>32</sup> It should be noted that choice '\*' on the above table represents respondents that left Item No.7 without answer. Their neglect is considered as if they have no idea about the item.

express. The figures in general depict that there are some terms that do not conceptually express the concepts that they should have expressed. The researcher also discovered many such terms while analyzing terms in students physics textbooks.

Item 8 is open ended question. It is designed to help respondents provide reason for their choice of item 7 (see appendix B1 and B2).

The students provided various reasons. According to some of them, there are mismatches between terms and their definitions. They also reported the presence of needless terms that should be avoided. Some indicated that many of the terms are not Oromo; there are many unknown terms. In some cases, according to the students, a single term has various meanings. In the same way, teachers stated that some terms do not express the intended concept since their definitions do not contain concepts that should have been included. Such problems were also identified during the analysis of terms in students' physics textbooks.

Item 13 is about dominant factors that contribute to conceptual inappropriateness of the terms. Various options were provided for the respondents and their responses presented in Table 11 are obtained.

I.13	Among the following, which one characterizes terms in your (your students) physics textbook? (You may choose more than one)	SR			TR		
		F	%	NS	F	%	NT
A	meaning of a term varies across texts	58	26.24	168	13	26	30
B	not equivalent with corresponding English <sup>33</sup> terms	54	24.43		9	18	
C	the ideas they express are not clear	35	15.84		13	26	
D	one term stands for many concepts	63	28.51		15	30	
E	others	00	00		00	00	

<sup>33</sup> This option is included since many of the terms are presented in students textbooks with their equivalent English.

* <sup>34</sup>	not sure about the problems	11	4.98		00	00	
Total		221	100		50	100	

**Table 11 Common problems in Oromo physics terms**

Table 11, depicts that 58 (26.24%) of the students indicated that variation of meaning of terms across the texts is dominant problem of the terms in students' physics textbooks. The meaning given to a term in one page of the text appears with another meaning elsewhere across and within the texts. 54 (24.43%) of the students, on the other hand, indicated that some of the terms are not equivalent with corresponding English terms while 35 (15.84%) of them expressed that the idea that the terms express is not clear. Many of the students, 63 (28.51%) nevertheless, responded that a single term expresses more than one concept; the terms are polysemous. Furthermore, 11 (4.98%) of the respondents replied that they are not sure about the problem.

Table 11 further indicates that 13 (26%) of the teachers held the view that meaning of some terms vary across the text. On the other hand, 9(18%) of them agreed that the terms are not conceptually equivalent with corresponding English physics terms. 13 (26 %) of the respondents responded the existence of polysemous terms. 15 (30 %) of them indicated that the idea that a term expresses is not clear. Thus, figures in Table 11 in general, depicts that all mentioned sorts of problems exist in Oromo though polysemy is the dominant one. Many polysemous terms were also identified by the researcher (see appendix D9).

The presence of such polysemous terms reminds us the suggestions made by many scholars. Felber (1984) indicates that such uncontrolled development of terms gives rises to confused situations in communication. Likewise, Christopher (2002) claims that haphazard adaptation of particular term to represent a concept causes problems in communications. The responses indicate conceptual ambiguity among terms which Draskau (1985) and Felber (1984) assert that fundamental problems in terms of many languages. Likewise, Aragaw (2009) identifies that there are such polysemuos terms

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<sup>34</sup> Choice\* represents respondents that left the item without answer.

which are raising confusion in Amharic natural science terms. Adugna (2009, p.42) as well identifies the presence of a term for a several concepts and the incompatibility of these terms with the intended concepts. He indicates that a single concept is represented by different terms and different concepts are designated by a term as well.

#### 4.2.1.3 Respondents Response on Term Usage

The following is presentation of students' and teachers responses' on definition of terms, relation between problems of terms and subject matter understanding and impact of term-related problems on students' interest toward the subject respectively.

##### 1) Responses on Presentation of Terms in Students' Physics Textbooks

Item 9, 10, 11 and 12 are about definitions of terms. Item 9 is regarding respondents view about definitions of terms. Both students and teachers highlighted existence of definition of terms that need due consideration. Table 12 presents information about clarity of definitions of terms.

I.9	What do you say about definitions of terms in your (your students) physics textbook?	SR		TR	
		F	%	F	%
A	very clear	04	2.28	06	20
B	clear	40	23.81	05	16.67
C	clear to some extent	83	49.40	11	36.67
D	unclear	28	16.67	08	26.67
E	very unclear	13	7.74	00	00
Total		168	100	30	100

**Table 12 Degree of clarity of definition of terms**

As can be observed from Table 12, there are many students who agreed that the definitions of terms are clear. 40 (23.81%) of the respondents indicated that the definitions given for the terms are clear. Similarly, 04 (2.28%) of the respondents responded that the definitions are very clear. However, the over all responses of the students' don not indicate the full presence of clarity in definitions of terms as 83 (49.40%) of them responded that only

some of the terms are clear. Furthermore, 28 (16.67%) of the respondents indicated that the definitions of terms are unclear. The remaining 13 (7.74%) of the students agreed that the definition of terms are very unclear. The figure illustrates that the number of students who agreed on the absence of clarity is greater than those who are hesitant about clarity of the terms.

In the same way, 06 (20 %) of the teachers responded that the definitions are very clear while 05 (16.67%) of the teachers indicated that the definitions of the terms in students' physics textbooks are clear. Conversely, 11 (36.67%) of the respondents indicated that the definitions of terms are clear only to some degree. 08 (26.67) of the respondents also indicated that the definitions given for the terms are not clear. Based on these facts, it is likely to conclude that there are some problems of definitions of terms in students' physics textbooks.

Item 10 is open ended question. It is designed to get further information from respondents regarding definitions and explanations of terms.

Students provided different reasons. Some of them stated the existence of some definitions which are very complex and very similar. Some definitions are also difficult to understand as they are written by using incorrect language, as they said. Physics teachers also indicated that the definitions of some terms are not given. Even the existing definitions of terms are not clear. They claimed that some definition of terms do not exactly express the concepts to be expressed. Item 11 is regarding adequacy of definitions of terms. The responses obtained from respondents are elicited in the following table.

I.11	How much do you think that the definitions given for the terms in your (your students) physics textbook are sufficient?	SR		TR	
		F	%	F	%
A	very sufficient	17	10.12	04	13.33
B	sufficient	34	20.24	03	10
C	sufficient to some extent	69	41.07	14	46.67
D	not sufficient	46	27.38	09	30

*	I have no idea <sup>35</sup>	2	1.19	00	00
Total		168	100	30	100

**Table 13 Sufficiency of Definition of Terms**

As far as adequacy of the definitions of the terms are concerned, 17 (10.12%) of the students indicated that the definitions given for these terms are very sufficient while 34 (20.24%) of them agreed that the definitions are sufficient. 69 (41.07%) of the respondents indicated that the definitions given for the terms are sufficient to some extent. Moreover, 46 (27.38%) of the students expressed that the definitions are not sufficient while 02 (1.19%) of them indicated that they have no idea about sufficiency of definitions of the terms in the textbooks.

It is also possible to observe from Table 13 that 04 (13.33%) of the teachers believe that the definitions given for the terms are very sufficient, and 03 (10 %) of them showed that the definitions are sufficient. However, 14 (46.66%) of the teachers agreed that the definitions are sufficient only to some extent while the remaining 09 (30%) indicated that the definitions of terms are not sufficient. The figure indicates that the many teachers have uncertainty on sufficiency of definitions given for the terms in students' textbooks. From the overall figure, one can conclude that in physics textbooks, there are terms that lack sufficient definitions. The terms lack the requirements that Draskau (1985) recommends to be included in the definitions of terms.

Item 12 focuses on possible errors types in defining terms in students' physics textbooks as presented in the following table.

I.12	If you answer is C or D for item No.11 why do you think that they are insufficient? (you may choose more than once)	SR			TR		
		F	%	NS	F	%	NT
A	not meaningful	34	24.81	115	9	26.47	23

<sup>35</sup> Choice \* on **Table 13** represents respondents who neglected answering Item No.11. Their responses are considered as if they have no idea about the item.

B	incomplete	45	32.85		11	32.35	
C	repeat the same concept	37	27.01		8	23.53	
D	they include unnecessary concepts	21	15.33		6	17.64	
E	others	00	00		00	00	
Total		137	100		34	100	

**Table 14 Possible error types in defining terms**

As Table 14 illustrates, among 115 students who agreed on the existence of problems of definition of terms, 34 (24.81%) of them indicated that the definitions given for the terms are not meaningful. They are not able to provide all characteristics contained in the concept of terms. 45 (32.85%) of them, nevertheless, believe that the definitions are incomplete. There is missed information. 37 (27.01%) of the students indicated that the definitions have circularity problems. Some of the respondents, 21 (15.33%), further expressed that the definitions of some terms contain unnecessary concepts. They are indicating that the definitions are not able to provide specific explanations about the terms under consideration.

Table 14 also depicts that among 23 teacher that agreed on the presence of definition problems, 09 (26.47%) of the teachers agreed that the definitions are not meaningful. However, 11 (32.35%) of the teachers had the view that definitions given to the terms in students' physics textbooks are incomplete while 08 (23.53%) of them think that the definitions are circular. 06 (17.64) of the teachers reported that the terms contain unnecessary concepts. From the over all figure, it is possible to conclude that circularity, incompleteness and meaninglessness are major problems of definitions of terms. It seems that the problems of definition that Draskau (1985) identified are visible in some Oromo physics terms.

## **2) Chain between Term-Related Problems and Subject Understanding**

Item No.14 and 15 in the questionnaire are regarding whether term-related problems affect students' subject understanding or not. Information obtained from both respondents illustrates that there is strong relation between term-related problems and subject matter

understanding. Significant numbers of respondents asserts that term-related problems affect students understanding.

I.14	Do you think that there are term-related problems that affect your (your students) understanding of the subject matter?	SR		TR	
		F	%	F	%
A	yes	109	64.88	18	60
B	no	53	31.55	10	33.33
*	no idea <sup>36</sup>	6	3.57	02	6.66
Total		168	100	30	100

**Table 15 Impacts of term-related problems on understanding the subject**

Table 15 clearly depicts that large number of students think that problems within the terms affect their understanding of the subject. 109 (64.88%) of the students reported that they are being affected by term-related problems. 53 (31.55%) of the respondents, in contrast, indicated that there are no term-related problems that affect their understanding of the subject matter. A few of them 06 (3.57%) reported that they are not sure whether the terms are affecting them or not.

Concerning physics teachers, the data illustrated in Table 15 show that more than half, 18 (60%), of the teachers think that term-related problems affect students' understanding of the subject matter. On the other hand, 10 (33.33%) of the teachers indicated that term-related problems have no impact on students' subject matter understanding while the remaining 02 (6.66 %) ascertained that they have no idea at all. The general figure tells us that the students are suffering from difficulty of understanding subject matter due to term-

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<sup>36</sup> Note that the respondents who lift the item unanswered are perceived if they have no idea about the item.

related problems prevailing in the physics terms. This outcome is similar with that of Taye's (2003) who reported that Amharic terms are affecting students understanding of the subject. Almost similar conclusion was made by Aragaw (2009). However, Wndimu (2009) in his thesis on Afan Oromo as Medium of Science, concludes that using Oromo as medium of science has no impact on students understanding. Nonetheless, his focus was on using language in general rather than problems of terminology. He in fact touched in pass that there are some problems of terms.

Item No.15 is about the extent to which term-related problems in students' textbooks influence subject understanding. Respondents' responses are presented in Table 16 as follow.

I.15	If your answer is 'Yes' for question No.14 to what extent you are affected?	SR		TR	
		F	%	F	%
A	affect greatly	21	19.27	03	16.67
B	affects	37	33.94	07	38.89
C	affect to some extent	51	49.79	08	44.44
<b>Total</b>		<b>109</b>	<b>100</b>	<b>18</b>	<b>100</b>

**Table 16 Degree of impact of term-related problems on understanding the subject**

From Table 16, it is easily observable that among 109 students who believe the existence term-related impact on students' understanding, 21 (19.27%) of them think that term-related problems greatly affect their understanding of the subject matter while 37 (33.94%) of the respondents reported that the problems affect their subject matter understanding. Nonetheless, 51 (49.79%) of the respondents indicated that term-related problems are affecting their understanding of subject matter to some extent.

Similar responses were reflected by the school teachers. 03 (16.67%) of them indicated the presence of term-related problems that greatly affecting students' comprehension. 07 (38.89%) of the respondents reported that the terms affect students' understanding whereas 08 (44.44%) of the respondents agreed that problems of physics terms affect the understanding of the students to some extent. From the figures as a whole, it can be argued

that there are term-related problems which affect students' understanding. Related to this, Taye (2003) reports that Amharic science terms which are being used at grade eight highly affect students understanding. It seems that in Oromo the extent of the effect is moderate. Taye (2003) reports, " Morphosyntactic and semantic variation can substantially influence students comprehension'. He also identifies four impacts of using Amharic terms as stated in 1.2.

### 3) Term-Related Problems and Interest toward the Subject

Under this section, students' and teachers' responses regarding the impact of Oromo physics terms on students' interest toward physics subject are presented. Item 16 and 17 are designed to address this issue. Responses from the respondents portray that term problems within physics textbooks do not affect students' interest toward the subject. The full responses are presented as follow.

I. 16	Do you think that terms in your physics textbooks affect your interest toward physics subject?	SR		TR	
		F	%	F	%
A	yes	65	38.69	14	46.67
B	no	99	58.93	14	46.67
*	no idea <sup>37</sup>	4	2.38	02	6.66
Total		168	100	30	100

**Table 17 the impact of term-related problems on students' interest**

Table 17 indicates that term- related problems have no strong impact on students' interest towards the subject. Only 65 (38.69%) of the respondents indicated that term-related problems have negative consequences on their interest toward the subject. However, large numbers of students think that the problems of terms and their outlook toward the subject have no relations. 99 (58.93%) of the students do have such kind of outlook. 04 (2.38%) of the students reported that they are not sure how much problems of the terms are related to their interest toward physics subject.

<sup>37</sup> Choice '\*' in the above table represents the number of respondents who left the item without answer.

Regarding physics teachers, Table 17 portrays that 14 (46.67) of the teachers think that term-related problems affect students' interest of the subject. Similar number, 14 (46.67 %) of the total teachers agree that the terms do not affect students' interest about the subject. This response does not indicate much attitudinal difference between students and teachers since the almost half of the teachers agreed that term-related problems do not affect students' interest towards the physics subject. There were also teachers who indicated that they have no idea whether the problems of the terms affect students' interest or not. 02 (14.29%) of the teachers reflected this attitude. Collective judgment of students' and teachers' responses illustrates that term-related problems have little impact on students' interest. Respondents' responses are against Keller's (1972) argument that term-related problems affect students' interest. Respondents' responses possibly have relation with their positive outlook towards using their language as medium of instruction.

Item 17 is aimed at gathering information regarding the degree of impact of term-related problems. The following data were obtained from the respondents.

I.17	If your answer is 'yes' for question No.16 to what extent you (they are) are affected?	SR		TR	
		F	%	F	%
A	affects greatly	13	20	03	21.43
B	affects	19	29.23	02	14.29
C	affects to some extent	33	50.77	09	64.29
Total		65	100	14	100

**Table 18 Level of impact of terms on students understanding**

As can be seen from Table 18, among 65 students who indicated that the problems within terms do affect their interest in physics, 33 (50.77%) of them reported that the term-related problems have medium impact on their interest while 19 (29.23%) of the respondents indicated that they are facing great challenges from term-related influences. 13 (20%) of the students reported that the influence is very great.

The evidences on Table 18 further illustrate that 03 (21.43 %) of the teachers think that term- related problems greatly affect students' interest toward the subject while 02 (14.29 %) of the teachers reported that the effect is great. However, 09 (64.29%) of them agree that the problems of terms affects students' interest only at certain extent. The figures in general indicate that majority of the respondents think that these term-related problems have medium influence on students' interest. From Table 17 and Table 18, it is possible to say that many students are not facing serious challenges from term-related problems as far as their interests are concerned. This conclusion indicates the absence of negative relationship between terms and interest in contrast to what Keller (1972) indicated, "Knowing a term adds interest to students."

Item 18 is open ended question which is aimed at seeking solutions for problems of terms in students' physics textbooks as stated below.

Q.18. Would you please, mention if you have general comment or recommendation on the appropriateness and usage of Oromo physics terms?

Students forwarded various recommendations that they think vital in the attempt of minimizing these challenges. Some of them indicated that for many of the terms are foreign terms, they should be developed from their own language. They added memorizing these terms take too much time and knowing these terms require knowledge of English. A number of students also recommended that definition of terms should be provided in the glossary. Terms containing problems should be re-examined and replaced by other appropriate terms. Symbols replacing terms are very difficult for identification and conceptualization, therefore, they should be revised. Others indicated that for some in-text definitions of certain terms are long, they should be short. They indicated that terms should be formed depending on the rules of the language. Finally, some of them stressed that indigenous term should be coined from words known by majority of the speakers of the language.

Teachers also made their own personal suggestions. Some of them indicated that definitions of terms should be provided at the end of every chapter. Subject specialist, language scholars and other responsible body should revise the existing terms in harmonized way. There were also teachers who indicated that some definitions of terms are very offensive and therefore should be revised. They also suggested that terms should be developed from the words that students easily understand.

#### **4.2.2. Presentation and Analysis of Information Obtained from Interviews**

Here are presentations of responses obtained from students', teachers' and scholars' interviews. Among various responses obtained from the discussions held with the above groups of samples, the major ideas are presented by dividing them into five dominant conceptual categories.

##### **4.2.2.1 Responses on Linguistic Appropriateness of Terms**

Many students complain that some terms which are developed from the Oromo language are unknown in the dialect they speak. A student at Hirna No.1 Elementary School claimed, "These terms resemble the words of other languages; there is domination of Wellega dialect." Many teachers also agreed that dialect is one factor that makes understanding terms in the students' physics textbooks so challenging. There were also teacher who ascertained that some of the terms are not known by the students. A teacher at Ciroo No.1 Elementary School stated *sadaata* 'relativity' and *summugamuu* 'to be compressed' as examples. Another teacher at Hirna No.1 Elementary School mentioned *guula* 'gravity' and *sinina* 'induction' as instances.

Many of the students' responses on linguistic appropriateness of terms are not different from what they responded on the questionnaires. The majority of them believe that excess terms are borrowed from English and that they do not understand English terms as they do Oromo terms. Except some respondents, a number of students ascertained that they prefer Oromo terms to English. Many teachers also share this idea. However, as presented in Table 1 many of physics terms are borrowed terms.

Regarding students' and teachers' complain that borrowed English terms are making understanding the terms challenging, physics scholar at Oromiya Education Bureau responded, "We need our students to develop their knowledge to global level and that is why many English terms are borrowed." Regarding domination of one dialect that the students and teachers raised, the scholar argued that which dialect should be used is not a big deal. He stated, "What ever the dialect would be, we use any term as far as it is used by the speakers of the language, our concern is on standardizing the language." Afan Oromo specialist on her part indicated, "I personally agree that there is problem of directly translating terms from English." She also admitted that she agrees with students' and teachers' complain that some of the terms are dialectally limited to specific areas.

#### **4.2.2.2 Responses on Conceptual Appropriateness of Terms**

The students complained that term-symbol relationship is making understanding difficult for they must have good English background to know from which term the symbols are derived. Some teachers also indicated the existence of some students who often ask questions about meaning of terms. For instance, a teacher who is teaching grade eight students at Hirna No.1 Elementary School said, "Some times it is even difficult for us to explain what a term exactly means as we have no references of definitions of terms." In fact, some of them agreed that many of their students can understand the terms.

A teacher at Ciroo No.1 Elementary School also asserted that though some terms are assumed to designate different concepts, they are perceived the same by some students. She mentioned terms such as *saffisa* 'speed', and *ʔariiti* 'velocity' as examples. She indicated, "The concepts these terms express in students' day to day communication and their concepts in physics are quite different." Some teachers also indicated that there are terms which don not clearly express what are intended to be expressed. Afan Oromo specialist on her part agreed that some newly coined terms are difficult for students' to understand.

However, physics specialist indicated that he has no assumption that terms that are being used in students' physics textbooks are very difficult for the students. He claimed, "Particularly for young students in the schools, the terms are not difficult; they are may be difficult for old generation." According to his view, young students in the school are familiar with standardized terms.

#### **4.2.2.3 Responses on Usage of Terms**

Concerning the problems of terms on interest toward the subject, many students agree that they do not like physics. Nonetheless, they hate the subject since they think that it is difficult. A student at Debesso Elementary School asserted, "I don't like physics since my elder friends told me that physics questions that appear on 'Ministry' are difficult. So, I don't want to waste my time." Similarly, a teacher at Ciroo Elementary School said, "Students dislike the subject simply since they think it is difficult." Correspondingly, many teachers indicated that though many students do have negative attitude towards the physics subject, this negative attitude has no relation with the problems of terms. There were also students who reported that they like physics and using Oromo terms as well. It seems that many students reflect positive outlook about the terms since they have positive attitude about using the language as medium of science.

Responses obtained from students indicate that many of them complain the difficulty of relating terms with their respective symbols. They claim that they are facing challenges of identifying which term stands for which symbol. Accordingly, Oromo physics terms are symbolized by the first letter of English terms. For instance, *guula* 'acceleration' is represented by the first letter of acceleration-'a'. *dalgee* 'width' is represented by the first letter of width-'w' , *deerina* 'length' by first letter of length- 'l' and *dakikaa* 'minute' by first letter of minute-'m'. According to the students, though knowing these symbols helps them in the future when medium of instruction is English, they are posing difficulty as they have to always remember which English letter stands for which Oromo term. The researcher also observed various such kinds of term-symbol relation in the texts. Like students, some teachers commented on the relation between terms and letters that are used to symbolize these terms. They indicated that students often face difficulty of

understanding which term is represented by which symbol. They believe that students take much time to understand some terms and relating them to their respective symbols.

The students also indicated the presence of arrangement mismatch between the numbers and units in using these terms. Accordingly, though in Oromo unit precedes the number, as for instance in kg 5 (kilogram five), the English number-unit configuration is used in presenting the terms, for instance, 5 kg. The students complain that they read English term-unit arrangement by using Oromo arrangement. They indicated that 'we read 5kg as *kilograama shan* 'kilogram five'. Regarding this, physics scholar argued, "No language is free from such problems; let alone Afan Oromo, highly developed languages such as Russians, France and German are facing similar problems. Accordingly, English symbols are also deliberately used to introduce the students to international usage of symbols.

#### **4.2.2.4 Term development and dissemination**

One of the interviewees who have been teaching physics for the last four years at Ciroom No.1 Elementary School indicated that there have been textbooks evaluation tasks. The evaluation takes place once in a year in his school. Comment on the problems of terms has been part of the evaluation processes. According to him, yet, there haven't been responses to their comments from the responsible bodies. He claimed, "Though we found some difficult and unclear terms, we have been using them as they are since we found no body that respond to our claims."

The scholars were asked if there have been mechanisms to check the school teachers' and students' feeling about the terms. Physics scholar asserted, "We believe that all students and teachers positively accept the terms though there hasn't been such assessment." This claim, however, contradicts with students' and teachers' responses. As indicated earlier, many teachers complained that their comments have been neglected. Regarding students' and teachers' complain about the accessibility of the terms for the users, the scholar responded, "All elementary schools have a manual containing definitions of terms; they can easily refer the meaning of terms from the manual." Contradiction between the scholar and teachers shows that there have been provision and distribution problems of the terms.

Regarding possibility of involving physics teachers in term development, the scholar asserted,

*There has not been possibility to have physics teachers participate in term development since it is difficult to do so. However, 'we'-the group of scholars<sup>38</sup> in Oromiya Education Bureau, often modify terms that seem irrelevant and replace them by the better ones while using them in students' textbooks (March 23, 2010).*

Concerning relation between term developer and text publisher, physics specialist said, "the printing press with high quality often won the computation. As they know their responsibility, we do not interfere in their work."

Oromo language specialist on her part indicated that the participant of the seminar composed of scholars who have been writing on Oromo language, and other authorities from different offices. She indicated that she has been participating on the seminar on behalf of Oromiya Education Bureau. Regarding background of the people who have been participating on both term development, she indicated, "The participants are Afan Oromo scholars and people from different offices" According to her, the whole effort has been on standardizing the language in general and she hasn't ever observed separate attempts that have been made for language which is used in specific profession. She added, "Hopefully, these issues are getting attention very recently." The scholar was also asked if there are some guidelines that they follow while developing terms. She responded, "I don't think there should be specified guidelines to coin terms. Since the scholars know the language they propose terms from their knowledge of language."

#### **4.2.2.5 Recommendations Forwarded by Interviewees**

Regarding the solution for term related problems, many students repeated points which are mentioned in the questionnaires. Using simple terms, using words which are found in their dialects, changing English terms to Oromo are some of them. Many teachers also

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<sup>38</sup> According to the interviewee, there is one subject specialist for all subjects: Chemistry, Biology, Physics and others.

recommended that subject specialists should participate in term development, and recommendations forwarded by school teachers should be considered in term development endeavors. They also forwarded revision of the existing textbooks to provide clear definition for some difficult terms and to correct some language errors that exist in the textbooks. They also recommended that list of definitions of these terms should be provided and distributed both for teachers and students.

## **Chapter Five: Summary, Conclusion and Recommendation**

### **5.1 Summary**

Here are synopses of the major points that have been discussed. Oromo is one of the Cushitic languages that are widely spoken in Ethiopia. It is one of the languages that have been recently privileged as medium of instruction. This opportunity has been given to local languages for their cognitive and psychological importance. Regardless of this importance, using vernacular languages as medium of instruction has its own limitations. Absence of vocabularies that precisely express the concept pertinent to particular instructional purpose is one of the limitations.

Based on this understanding, the need to examine the appropriateness and the use of physics terms in Oromo has been conceived. To this end, focus has been given primarily to grade seven and eight based on the assumption that term-related problems are dominant in these areas. Among various domains, physics terms were considered based on the researchers' interest, experience and natures of the terms. For analysis of the appropriateness of the terms in the domain, text analysis was used as data gathering devices. Quantitative data were gathered from students and physics teachers in fourteen second cycle primary schools in West Harargae Zone and from scholars that have been participating on term development and usage. Questionnaire and interview were used as tools for this purpose.

Regarding questionnaires, 15% of the total students were taken from each of the three schools sampled for this purpose. Among 15% students in each school, 25%, 50% and

25% respectively were taken from lower, medium, and higher achievers. Among 174 students identified through this procedure, 168 students responded to the questionnaires. Thirty physics teachers from 14 schools were also selected for questionnaire. Concerning interview, five students from each of the three schools and total of fifteen students were randomly recruited and interviewed. Likewise, seven teachers from the three schools were also interviewed. The sampling technique for interview was random sampling. One Oromo specialist and one physics specialist who are working in Oromiya Education Bureau were also interviewed. Three physics teachers were also served as consultant to explain some concept of terms that require professional expertise.

To analyze linguistic and conceptual appropriateness of terms that were collected through text analysis, some principles and guidelines were adopted. Principle of authenticity, principle of borrowing and principle of manipulability or derivability were adopted for analysis of linguistic appropriateness of terms. Similarly, principle of motivation, principle of semantic transparency, principle of synonymy and polysemy, principle of conceptual equivalence and principle of compounding were used for analysis of conceptual appropriateness of the terms. To examine how terms presented across texts, orthographic consistency and definiendum-definiens correspondence were considered. Finally, to present facts in respondents' responses, the data obtained were presented and analyzed by using tables and some statistical devices such as frequency count and percentile.

## **5.2 Conclusion**

Based on the findings obtained through the above procedures, the following conclusions are made.

Analyses of the terms collected from students' physics textbooks reveal that many of the terms in students' physics textbooks are borrowed terms. This implies that there has been a tendency of adopting English terms rather than exploiting the vocabulary of the target language. This preference of source language does not coincide with students' and teachers' preference of source languages. Besides, some terms are not authentic or explainable in terms of rules in the target language. They contain phoneme configuration

which cannot be explained interns of target language. The investigation also shows that some terms are unnecessarily borrowed while some others are borrowed without considering language rules of the target language. Moreover, some terms lack potential derivatives while some contain unnecessarily added suffixes. Problem of orthographic inconsistency has also been dominant in the terms. There are also terms which are semantically unmotivated.

Presence of great number of synonymous and polysemious terms in students' physics textbooks is another challenge that needs consideration. Absence of conceptual equivalence between terms of source language and target language has also been identified. Mismatch between terms and their respective symbols is another challenge as far as these terms are concerned. The way terms are defined was also found to be problematic. Some terms are incorrectly defined and carelessly presented. There are also terms which lack sufficient definitions and explanations. Some of the definitions are circular and incomplete. Term-related problems are factors for students' weak understanding of the subject matter to some degree. These all proves pointes stated in the hypothesis. Nonetheless, the findings show that problems of the terms have little impact on students' interest towards the subject. Many students are not facing serious challenges from term-related problems as far as their interest toward the subject is concerned. This conclusion is different from researcher's prior expectation as he assumed that term-related problems have negative consequence on students' interest.

Depending on the responses obtained from students', teachers' and scholars' interviews, it can be ascertained that there has been lack of cooperation among term developers and term users. Absence of opportunities to engage scholars from various sectors, particularly, subject specialists in term development endeavor has resulted in development of doubtful terms. Absence of inclusiveness in considering all existing dialects of the language in term development has been source of problems of term understanding. Lack of definitions of terms in the glossary has also been one factor which is hindering easy understanding of the terms.

### **5.3 Recommendations**

Here are presented recommendations for appropriate development and usage of physics terms in grade seven and eight students' physics textbooks. On the bases of findings recapitulated above, the following suggestions are forwarded.

- ❖ Scholars who are involved on development of terms should consider linguistic features of the terms such as pronunciation and derivability.
- ❖ Conceptual appropriateness of physics terms including their degree of expressivity, transparency and conceptual consistency ought to be reconsidered to minimize problems of term understanding.
- ❖ Problems of term presentation such as spelling variations and incorrect definitions should be checked before the materials are distributed for the users. The problems in the existing texts should also be revised.
- ❖ Collaborative efforts should be established among various scholars including subject specialists, linguists, terminologists and other responsible body to alleviate existing problems of physics terms.
- ❖ There should be feedback mechanisms for reaction of students and teachers toward the terms. Besides, pilot test on some selected schools should be made before the terms are published in students' textbooks and disseminated to the users.
- ❖ All vocabulary in all dialects of the language should be assessed before developing a term. To achieve this, scholars from various dialects speaking community should be allowed to participate in the process of term development.
- ❖ The presence or absence of a term for a concept should be exhaustively investigated in the language before developing new term since uncontrolled

coinage of terms are resulting in provision of synonymy terms which in turn leads to confusion.

- ❖ Rather than confusing students with numerous English terms and symbols, the target language should be thoroughly exploited for teaching physics. Language problems that emerge after transition from Oromo to English should be handled within the English course curriculum.
- ❖ Term-symbol variations which are confusing students should be minimized either by utilizing the first letter of Oromo terms or by using consistently both the symbols and terms of the English language.
- ❖ Further investigations should be done on other natural science domains such as chemistry and Biology to alleviate the existing terminological challenges and to smooth the use of the terms in teaching-learning processes.
- ❖ Region wide survey should be carried out to identify the existing terminological challenges and to propose more comprehensive ways of minimizing the challenges.
- ❖ Strong language center which will be responsible for term standardization should be established.

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## Appendix A

### Schools and Number of Physics Teachers Participated in the Questionnaire

	<b>Name of schools</b>	<b>No</b>	<b>Location</b>
1	Hirna No.1 Elementary School	2	Hirna
2	Hirna No.2 Elementary School	2	Hirna
3	Ethiopia Tikdem Elementary School	2	Hirna
4	Ciroo No.1 Elementary School (Amala Sirressaa)	3	Coroo
5	Ciroo Killiso No.1 Elementary School	2	Ciroo
6	Ciroo Killiso No.3 Elementary School	2	Ciroo
7	Ciroo Baakaa Elementary School	3	Ciroo
8	Debesso Elementary School	2	Debbesso
9	Alberekete Elementary School	2	Around Giroo
10	Midhagduu Elementary School	2	Around Hirna
11	Fugnaan Diimoo Elementary School	2	Around Giroo
12	Yaaboo Shambaqoo Elementary School	2	Ciroo
13	Qunnee Elementary School	2	Around Giroo
14	Mexxaqashaa Elementary School	2	Around Giroo
<b>Total</b>	<b>14</b>	<b>30</b>	

## **Appendix B**

### **Appendix B1**

#### **Questionnaire for Grade Seven and Eight Students**

Dear student:

This questionnaire is designed to gather relevant information about physics terms in your physics text book. Terms are words like speed, acceleration, distance, displacement, velocity etc. Since your genuine response will be vital to explore facts about these terms, I would request you to rigorously answer the items in this questionnaire. The questionnaire consists of two parts. The first part is about your own personal information, while the second part contains questions regarding physics terms. Read all the parts thoroughly and respond to them accordingly.

I thank you for spending your time to answer the items.

#### ***Part I. Personal Information***

Circle one of the options that express you very well.

- 1. Age:** A) below 10    B) 10-15    C) 15-20    D) above 20
- 2. Sex:**    A) Male            B) Female
- 3. Grade:**    A) Seven            B) Eight

**4. Name of your school:**

- A) Ciroom Elementary Junior School
- B) Debbesso Elementary Junior School
- C) Hirna No.1 Elementary Junior School

***Part II. Term-Related Questions***

Answer the following question by circling the option that you think appropriate and by providing possible information on the space provided.

1. Pronouncing terms in your physics text book is:  
A) very easy    B) easy    C) medium    D) difficult    E) very difficult
2. If your choice for question No.1 is C, D or E, why do you think that they are difficult to pronounce? (you may circle more than one alternative)  
A) they contain strange sounds    B) the arrangement of the sounds is not familiar  
C) presence of long terms    D) others \_\_\_\_\_  
A) Oromo    B) English    C) Amharic    D) other languages \_\_\_\_\_
3. Terms of which language do you think easy to understand?  
A) Oromo    B) English    C) Amharic    D) others \_\_\_\_\_
4. Do you think that Oromo physics terms are linguistically appropriate in general?  
A) Yes, they are    B) yes, to some extent    C) no, they are not
5. What do you think about level of understandability of the terms?  
A) They are easily understandable  
B) Some of them are not understandable  
C) Many of them are not understandable  
D) All of them are not understandable
6. Would you please provide reason for your choice of item No.5?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

7. Do you think that physics terms in your textbook express what they are intended to express?

A) Yes, they do B) Only some of them can do C) No, they do not

8. If your answer for question No. 7 is B or C, would you please explain why they do not express?

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9. What do you say about definitions of terms in your physics textbook?

A) they are very clear B) they are clear C) they are clear to some extent

D) they are unclear E) they are very unclear

10. Would you please supply reason for you choice of item No.9?

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11. How much do you think that the definitions given for the terms in your physics textbook are sufficient?

A) very sufficient B) sufficient C) sufficient to some extent D) not sufficient at all

12. If you answer is C or D for item No.12, why do you think that they are insufficient?

A) they are not meaningful

B) they are incomplete definition

C) they repeat the same concept

D) they include unnecessary concepts

E) others\_\_\_\_\_

13. Among the following, which one characterizes terms in your physics text book? (You may choose more than one)

A) meaning varies across the text

B) they are not conceptually equivalent with corresponding English terms

C) the ideas they express are not clear

D) one term stands for many concepts

E) others \_\_\_\_\_

14. Do you think that there are term-related problems that affect your understanding of the subjectmatter?

A) Yes, they are      B) No, they are not

15. if your answer is 'Yes' for question No.14 to what extent you are affected?

A) very greatly   B) greatly   C) to some extent

16. Do you think that terms in your physics text book affect your interest toward physics subject?

A) Yes                      B) No

17. If your Answer is 'yes' for Question No.6, to what extent you are affected?

A) affects greatly   B) affects   C) affects to some extent

18. Would you please mention if you have general comment or recommendation on the appropriateness and usage of Oromo Physics Terms?

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*Thank you very much*

## Appendix B2

### Questionnaire for Physics Teachers

Dear Teacher:

This questionnaire is designed to gather relevant information about physics terms in your students' physics textbooks. Since your genuine response will be vital to explore facts about these terms, I would request you to rigorously answer all the items in this questionnaire. The questionnaire consists of two parts. The first part is about your own personal information, while the second part contains questions regarding physics terms. Read all the parts thoroughly and respond to them accordingly.

I thank you for spending your time to answer the items.

#### *Part I. Personal Information*

Circle one of the options that express you very well.

**1. Sex:**     A) Male            B) Female

**2. Status:**   A) certificate   B) diploma   C) degree

**3. Year of experience in teaching physics:** A) 1-4    B) 4-8    C) 8-12

D) 12-16    E) 19-20    F) more than 20

**4. Name of your school:**

A) Ciroo Elementary Junior School

- B) Dabbasso Elementary Junior School
- C) Hirna No.1 Elementary Junior School

**Part II. Term-Related Questions**

Would you please answer the following question by circling the option that you think appropriate and by providing possible information on the space provided?

1. Pronouncing terms in students' physics textbook is:
  - A) very easy    B) easy    C) medium    D) difficult    E) very difficult
2. If your choice for question No.1 is C, D or E, why do you think that they are difficult to pronounce? (you may circle more than one alternative)
  - A) they contain strange sounds            B) the arrangement of the sounds is not familiar
  - C) presence of long terms    D) others \_\_\_\_\_
3. Terms of which language do you think easy for students to understand?
  - A) Oromo                                    B) English                                    C) Amharic    D) others \_\_\_\_\_
4. Do you think that Oromo physics terms are linguistically appropriate in general?
  - A) Yes, they are            B) yes, to some extent    C) no, they are not
5. What do you think about level of understandability of the terms to your students?
  - A) they are easily understandable.
  - B) some are not understandable.
  - C) many of them are not understandable.
  - D) all are not understandable.
6. Would you please provide reason for your choice of item No.5?

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7. Do you think that physics terms in students' physics textbooks express what they are intended to express?
  - A) Yes, they do            B) some of them do not                    C) no, they do not

8. If your answer for question No. 7 is B or C, would you please explain why?

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9. What do you say about definition and explanation of terms in students' physics textbooks?

- A) They are very clear.
- B) They are clear.
- C) They are clear to some extent
- D) They unclear
- E) they are very unclear

10. Would you please provide reason for you choice of item No.9?

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11. How much do you think that the definitions or explanations given to the terms in students' textbooks are sufficient?

- A) very sufficient
- B) sufficient
- C) sufficient to some extent
- D) not sufficient at all

12. If you answer is C or D for item No.11, why do you think that they are insufficient (you can choose more than one option)?

- A) not meaningful
- B) They are incomplete definition
- C) They repeat the same concept
- D) They include unnecessary concepts
- E) others \_\_\_\_\_

13. Among the following, which one characterizes terms in students' physics textbooks? (You can choose more than one)

- A) meaning varies across the texts
- B) they are not equivalent with corresponding English terms
- C) The ideas they express are not clear
- D) one term stands for many concepts

E) others \_\_\_\_\_

14. Do you think that there are term-related problems that affect your students' understanding of the subject?

A) Yes, they are      B) No, they are not

15. If your answer is 'Yes' for question No.14 to what extent they are affected?

A) affect greatly   B) affect   C) affect to some extent

16 do you feel that physics terms problems in students' textbooks affect students' interest toward physics subject?

A) Yes      B) No

17 If your answer for question No.19, is 'Yes' to what extent do you think they are affected?

A) very greatly   B) affects   C) affects to some extent

18. Would you please mention if you have general comment or recommendation on the appropriateness and usage of Oromo Physics Terms?

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***Thank you very much***

## Appendix B3

### *Gaafannoo Barattoota Kutaa Torbaffaatii fi Saddettaffaatiiff Qophaaye*

Barattoota:

Gafannoon kun tarmoota phiiysiiksi kan kitaaba phiiysiksii kessan keessa jiran kan ilaalatuu dha. Tarmii jachuun Jachoota akka guula, saffisa, qaxxaamura, keenamaatiiksii fi kan kana fakkaatan hunda jachuu dha. Deebiin isin gaffilee armaaangaditiif laattan rakko tarmoota kanaa wajjiin walqabatan furuuf bayyee waan barbaachisuuf gaaffilee armaan gadii hunda sirritti eerga dubbistan booda yaada sirri isinitti fakkaate akka deebstan kabajaa guddaa wajjiniin isin hubachiisa.

gaafannon kun bakka lamatti kan qoodamee yammuu ta'uu, inni duraa ragaa waa'ee enyummaa kessani sassaaburatti kan xiyyafate yammuu ta'uu inni lamadaa rakko tarmootaa wajjin walqabatan funaanu irrati kan xiyyefatee dha. Kanaafu gaaffi hunda deebisuu kessan dura ajaja isaani laatame dubbisuun barbaachisaa dha.

Galata guddaa wajjiin

#### *Qaama I. Ragaa Dhunfaa*

Fillanno armaan gaditti kannamee kessaa isa sirritii si ibsuu filadhu.

**1. Urmii:** A) waggaa 10 gadii B) 10-15 C) 15-20 D) waggaa 20 oli

2. saala: A) Dhiira B) Durba

3. kutaa: A) 7ffaa B) 8ffaa

4. Maqaa mana baruumsa keeti:

A) Mana Baruumsa Ciroo Sadarkaa Tokkoffaa

B) Mana Baruumsa Debbesso sadarkaa Tokkoffaa

C) Mana Baruumsa Hirnaa Sadarkaa Tokkoffaa

### ***Qaama II. Gaaffilee Tarmoota Wajjiin Walqabatan***

Gaaffilee armaan gadii erga duubiste booda fillanno siif dhiyatan kessaa isa sirri sitti fakkatee gengoo itti maruun deeb sii.

1. Tarmoota phiiysiiksii kan kitaaba kee keessatti argaman yammuu dubistu:

A) baayee salphaa dha B) salphaadha C) judduu galeesa D) ulfaataadha

E) baayee ulfaataa dha.

2. Deebiin gaaffii tokkoffaaf kannitee 'C', 'D' ykn 'E' yoo tahee, maaliif tarmoota kana dubbisuun ulfaataa sitti fakkataa? (deebii tokkoo ol kannuun ni danda'ama)

A) sagalee rakkissaa of keessaa qaban B) haalli tarrefama sagalee tarmaata kanaa rakkissaa dha C) tarmoonnii kun baay'ee dhadheeroo dha D) yaada biraaa

yaaqabaatte\_\_\_\_\_

3. Tarmoota afaan kam irraa fudhatameetu salphatti siif galaa?

A) Orimiffa B) Ingliiffa C) Amaariffa D) kan biraa\_\_\_\_\_

4. tarmoonni kun rakkina afaani irra walaba jattee yaaddu?

A) eyyeen C) eyyeen hamma tokko walaba C) lakkii,

5. Haala hikkaa tarmoota kanaa akkamitti madaalta?

A) salphattii namaa gala

B) tokko tokkoon isaani namaaf hingalan

C) baayyeen isaanii namaaf hingalan

D) hundii isaanii namaaf hingalan

6. Deebii gaaffii shanaffaaf kanitee maaaliif akka filatte ibsuu dandeessaa?

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7. Tarmooni kitaaba phiiysiiksii kessa jaran kun yaada ibsuu barbaadame sirritti ibsaa jiru jattee yaaddaa?

A) eeyyen sirritti ibsaa jiru B) isaan takko tokko hin ibsan C) hundii isaani sirrittii hin ibsan

8. Deebiin gaffii 7 ffaaf laatte 'B' ykn 'C' yoo ta'e maliif akka filatte armaan gaditti ibsii?

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9. Waa'ee hikkaa tarmoota kanaaf kitaabe phiiysiiksii kessattii kaname ilaalchise yada maali qabda?

A) baay'ee ifa B) ifa C) hamma tokko ifa D) ifa mitii E) baay'ee ifa miti

10. Deebii olitti filatte maal irraa kaate akka filattee ibsuu dandeessaa?

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11. Hiikkaafi ibsii termoota kanaaf kitaaba phiiysiiksii kessatti kaname ga'aa sittii fakkaataa?

A) baay'ee ga'aa dha B) ga'aa dha C) hamma tokka ga'aadha D) ga'aa miti

12. Deebien gaaffi 12ffaaf laatte 'C' ykn 'D' yoo ta'e rakkoon hikkaa fi ibsi kun qaban maali? ( deebii tokkoo ol laachuun ni danda'ama)

A) hiika hin qabu

B) hiika guutuu hin qabu

C) yaaduma tokko irra dadeebi'aa

D) yaada hinbarbaachiifne off kessati qabata

E) yaada biraa yoo qabaatte\_\_\_\_\_

13. Filanno armaan gadii keessaa isa kamtuu tarmi phiiysiiksii kitaaba kee kessatti argaman sirritti ibsuu danda'a? (deebi tokkoo ol filachuun ni danda'ama!)

A) hikkaan tarmii tokkof kanamee fuula kitaabaa tokkoo gara fuula birattii nijjirama

B) hikkaan tarmota kanaa hikkaa tarmi Ingliffaa wajjiin walhingituu

C) yaanni tarmooni kun ibsan ifa miti

D) tarmiin tokkoo yaada tokko ol bakka bu'a

E) kan biraa yoo qabaatte\_\_\_\_\_

14. Rakkoon tarmii wajjiin walqabatee kan barnoota phiiysiiksii sirritti akka hin qayabanne nagodha jatte yaaddu nijiraa ?

A) eeyyen, nijira B) lakki, hinjiru

15. Deebiin gaaffi 14ffaaf kanite 'eeyen' yoo ta'e rakkoon kunii hammam namiidhaa jira jatte yaadda?

A) baayye na midhaa jira B) na midhaa jira C) hamma tokko na midhaa jira

16. Tarmooni kitaaba phiiysiiksii kee kessa jiran fedhinnaa atii barnoota phiiysiiksii qabduu midhaa jira jatte yaaddaa?

A) eeyeen nimiidhaa B) lakki hinmiidhan

17. Deebiin gaaffi 16ffaaf laatte 'eeyyen', yoo ta'e, midhaan isaani hammam sitti fakkaata?

A) baay'e namidhan B) namidhan C) hamma tokka na midhaa

18. Tarmoota phiiysiiksii kan kitaaba phiiysiiksii kee kessa jiran ilaalchiise, rakko afaani, kan yaadaa, rakko fedhii barnoota phiiysiiksii irrati qaban akkasumaas barnoota phiiysiiksii sirritti qayabachu irrata dhibbaa isaan qaban furuuf furmaatni maali jatte yaadda? yaada furmaata nita'a jatte yadduu hunda armaan gaditti barressii?

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## Appendix B4

### *Gaafannoo Barsisaa Fiiziksiitiif Qophaa'e*

Barsiisa:

Gaafannoon kun tarmoota Fiiziksii kan kitaaba Fiiziksii keessa jiran kan ilaallatuu dha. Deebiin isin gaffilee armaaangaditiif laattan rakkoo tarmoota kana wajjin walqabatan furuuf baay'ee waan barbaachisuuf, gaaffilee armaan gadii hunda sirriitti eerga dubbistan booda yaada sirrii isinitti fakkaate akka deebistan kabajaa guddaa wajjiniinin isin hubachiisa.

Gaafannoon kun bakka lamatti kan qoodamee yommuu ta'u, inni duraa ragaa waa'ee enyummaa kessanii sassaaburatti kan xiyyeeffatee dha. Inni lammataa immoo rakkoo tarmootaa wajjin walqabatan funaanuu irrati kan xiyyeeffatee dha. Kanaafu gaaffi hunda deebisuu keessaniin dura ajaja isaanii laatame dubbisuun barbaachisaa dha.

Galatoomaa

### *Kutaa I. Ragaa Dhuunfaa*

Fillannoo armaan gaditti kannamee keessaa isa sirriittii si ibsu filadhu.

1. **saala:** A) dhiira B) durba
2. **sadarkaa barnootaa:** A) sartafikeeta B) Dipilomaa C) Diigrii
3. **waggaa hojii** A) Waggaa 5 gadii B) 5-10 C) 10-15 D) 15-20 E) Waggaa 20 ol

## ***Qaama II. Gaafilee Tarmoota Wajjiin Walqabatan***

Gaaffilee armaan gadii erga duubistan booda fillanno isiinif dhiyatan kessaa isa sirri isinitti fakkatee gengoo itti maruun deebisaa.

1. Tarmoota phiiysiiksii kan kitaaba barataa keessatti argaman barattootni yammuu dubissan:

- A) baayee salphaa dha    B) salphaadha    C) judduu galeesa    D) ulfaataadha  
E) baayee ulfaataa dha.

2. Deebiin gaaffii tokkoffaaf kannitan 'C', 'D' yookaan 'E' yoo tahee, maaliif tarmoota kana dubbisuun ulfaataa sitti fakkataa? (deebii tokkoo ol kannuun ni dandeessu)

- A) sagalee rakkissaa of keessaa qaban    B) haalli tarrefama sagalee tarmoota kanaa rakkisaa dha    C) tarmoonnii kun baay'ee dhadheeroo dha    D) yaada biraaa yaaqabaatte\_\_\_\_\_

3. Tarmoota afaan kam irraa fudhatameetu barattootaaf salphatti galaaf jattani yaaddu?

- A) Orimiffa    B) Ingliffa    C) Amaariffa    D) kan biraa\_\_\_\_\_

4. tarmoonni kun rakkina afaani irra walaba jatee yaaddu?

- A) eyyeen    C) eyyeen hamma tokko walaba    C) lakkii,

5. Haala hikkaa tarmoota kanaa akkamitti madaaltu? barattootaaf:

- A) salphattii gala  
B) tokko tokkoon isaani hingalan  
C) baayyeen isaanii hingalan  
D) hundii isaanii hingalan

6. Deebii gaaffii shanaffaaf kanitan maaaliif akka laattan ibsuu dandeessuu?

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7. Tarmoonni kitaaba phiiysiiksii kessa jaran kun yaada ibsuu barbaadame sirritti ibsaa jiru jattani yaaddu?

A) eeyyen sirritti ibsaa jiru B) isaan takko tokko hin ibsan C) hundii isaani sirrittii hin ibsan

8. Deebiin gaffii 7 ffaaf laattan 'B' ykn 'C' yoo ta'e maliif akka filattan armaan gaditti ibsaa?

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9. Waa'ee hikkaa tarmoota kanaaf kitaabe phiisiiksii kessattii kaname ilaalchise yada maali qabdu?

A) baay'ee ifa B) ifa C) hamma tokko ifa D) ifa mitii E) baay'ee ifa miti

10. Deebii olitti filattan maal irraa kaatani akka filattan ibsuu dandeessuu?

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11. Hiikkaafi ibsii termoota kanaaf kitaaba phiisiiksii kessatti kaname ga'aa isinittii fakkaataa?

A) baay'ee ga'aa dha B) ga'aa dha C) hamma tokka ga'aadha D) ga'aa miti

12. Deebien gaaffi 12ffaaf laattan 'C' ykn 'D' yoo ta'e rakkoon hikkaa fi ibsi kun qaban maali? ( deebii tokkoo ol laachuun ni danda'ama)

A) hiika hin qabu

B) hiika guutuu hin qabu

C) yaaduma tokko irra dadeebi'aa

D) yaada hinbarbaachiifne off kessati qabata

E) yaada biraa yoo qabaatte\_\_\_\_\_

13. Filanno armaan gadii keessaa isa kamtuu tarmi phiisiiksii kitaaba barataa kessatti argaman sirritti ibsuu danda'a? (deebi tokkoo ol filachuun ni danda'ama!)

A) hikkaan tarmii tokkof kanamee fuula kitaabaa tokkoo gara fuula birattii nijjirama

B) hikkaan tarmota kanaa hikkaa tarmi Ingliffaa wajjiin walhingituu

C) yaanni tarmoonni kun ibsan ifa miti

D) tarmiin tokkoo yaada tokko ol bakka bu'a

E) kan biraa yoo qabaatte\_\_\_\_\_

14. Rakkoon tarmii wajjiin walqabatee kan barnoota phiiysiksii barattoni sirritti akka hin qayabanne ni nagodha jatte yaaddu nijiraa ?

A) eeyyen, nijira      B) lakki, hinjiru

15. Deebiin gaaffi 14ffaaf kanite 'eeyen' yoo ta'e rakkoon kunii hammam barratoota namiidhaa jira jatte yaadda?

A) baayye na midhaa jira    B) na midhaa jira    C) hamma tokko na midhaa jira

16. Tarmoonni kitaaba phiiysiksii kee kessa jiran fedhinnaa baratootni barnoota fiiziksiitiif qaban ni midhaa jattanii yaadduu?

A) eyyeen nimiidhaa                  B) lakki hinmiidhan

17. Deebiin gaaffi 16ffaaf laattan 'eeyyen', yoo ta'e, midhaan isaani hammam sitti fakkaata?

A) baay'e namidhan    B) nimidhan    C) hamma tokka na midhaa

18. Tarmoota fiizsiiksii kan kitaaba fiiziiksii kessa jiran ilaalchiise, rakko afaani, kan yaadaa, rakko fedhii barnoota phiiysiiksii irrati qaban akkasumaas barnoota phiiysiiksii baratoonni sirritti qayyabachu irrata dhibbaa isaan qaban furuuf furmaatni maali jattani yaadduu? yaada furmaata nita'a jattee yadduu hunda armaan gaditti barressii?

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## **Appendix C**

### **Appendix C1**

#### **Interview Guide for Grade Seven and Eight Students**

1. What kind of challenges have you faced regarding terms in your physics textbooks?
2. Can you describe the nature of terms' problems?
3. Do you think that there problems of terms that make understanding physics concept difficult?
4. Would you please explain the strengths and weakness of the terms in terms of their conceptual and linguistic appropriateness in general?
5. Do you think that problems of the terms affect your interest and motivation toward the subject?
6. What solution do you propose for better provision and utilization of Oromo physics terms?

## **Appendix C2**

### **Interview Guides for Physics Teachers**

1. Would you please can you mention for how many years have you been teaching physics at these grade levels?
2. Do you think that there physics term related problems that call for urgent solution?
3. What kind of challenges have you faced regarding terms in your students' physics text books? Can you describe the nature of terms' problems?
4. What kind of problems do you think you as a teacher and your students have been facing regarding these terms?
5. Do you think that problems of the terms affect your interest and students motivation towards the subject?
6. Would you please explain the strengths and weakness of the terms in terms of their conceptual and linguistic acceptance?
7. What solution do you propose for better provision and utilization of Oromo physics terms?

## **Appendix C3**

### **Interview Guides for Officials in Oromiya Education of Bureau**

1. Would you please explain the members of your staff, education level, region and their field of specialization?
2. How each group member takes part in the endeavor to develop physics terms? Is there specific task that each staff member takes?
3. What kind of methods and guidelines do you use to develop physics terms?
4. What kind of relation do you have with text book writes?
5. Have you ever received, comments, suggestions or complains from the teachers and students? How do you respond to such comments?
6. Do you have any checking mechanism of responses of teachers and students regarding the terms you developed?
7. What are the major challenges that you have ever faced in developing Oromo physics terms?

## Appendix D: Terms that Needs Revision

### D1 problem of authenticity

<u>Problems</u>	<u>Terms</u>	<u>Grade</u>	<u>Page</u>	<u>Source</u>	<u>Methods</u>	<u>Meaning</u>
authenticity	gashaale	seven	120	Oromo	derivation	container
authenticity	gononnee	Eight	7	Oromo	coinage	permanent
authenticity	qodaa	seven	16	Oromo	coinage	container
configuration	traansiistaroota	Eight	102	English	borrowing	transistors
configuration	haayidiroomeetira	seven	19	English	borrowing	hydrometer
configuration	haayidiroolikii	seven	88	English	borrowing	hydraulic
configuration	tiraansifoormarii	Eight	60	English	borrowing	transformer

### D2.Unnecessary Borrowed Terms

borrowing	ji'oogiraafii	Eight	3	English	borrowing	geography
borrowing	konveenshinaalii	Eight	16	English	borrowing	conventional
borrowing	niwukilasii	Eight	12	English	borrowing	nucleus
borrowing	paartikilloota	Eight	11	English	borrowing	particles
borrowing	piroominaansii	Eight	86	English	borrowing	prominence
borrowing	proobileemota	seven	14	English	borrowing	problems
borrowing	silverii	Eight	27	English	borrowing	silver
borrowing	telefoona	seven	2	English	borrowing	telephone
borrowing	vaayooletti	Eight	73	English	borrowing	violet
borrowing	yunivarasii	Eight	82	English	borrowing	universe
borrowing	zeeroo	Eight	73	English	borrowing	zero

### D3.problems of compounding

compounding	nannoo irra galaanaa	seven	92	Oromo	loan translation	above see level
compounding	ulee meetiraa	seven	8	Oro &Eng	Hybridization	meter
compounding	ardii lafaa	seven	119	Oromo	compounding	continent
compounding	babal'achuukal tokkee	seven	119	Oromo	compounding	linear expansion

compounding	bali'ina shalaguu	seven	10	Oromo	compounding	calculating an area
compounding	bishaan bulluqaa	seven	98	Oromo	compounding	warm water
compounding	boca sirnaawaa	seven	119	Oromo	compounding	regular shape
compounding	caasaa atamii	Eight	12	Oro & Eng	Hybridization	atomic configuration
compounding	copha vooltajii	Eight	72	Oro & Eng	Hybridization	flow of voltage
compounding	daandii sirrii	Eight	28	Oromo	compounding	series circuit
compounding	faana kophee	seven	48	Oromo	compounding	sole of shoe
compounding	guula harkisa lafa	seven	34	Oromo	compounding	gravity
compounding	Hima walqixaa	Eight	101	Oromo	compounding	equation
compounding	humna mormii ijaajoo	Eight	101	Oromo	compounding	normal reaction
compounding	kaarantii kaltokkee qixxeessaa	Eight	101	Oromo	hybridization	force
compounding	proporshinaaliti	Eight	27	Oro & Eng	Hybridization	direct current
derivation	rigata sochii	Eight	101	Oromo	compounding	directly
derivation	seera Ohm	Eight	102	Oromo	hybridization	proportional
	sinina					sliding friction
derivation	electromaagneetii	Eight	102	Oromo	hybridization	Ohm's law
derivation	warshaale	seven	122	Oromo	derivational	electromagnetic force of induction
derivation	dabarsoo	Eight	13	Oromo	derivation	industry
derivation	elektroomaagnetizimii sinina	Eight	49	English	borrowing	transmitter
derivation	electromaagnitizimi	Eight	55	Oro&Eng	Hybridization	electromagnetism
derivation	taate maagnetummaa	Eight	44	Oro &Eng	Hybridization	electromagnetic induction
						magnetic effect
<b>D5.problems of orthography</b>						
orthographic	aseensiisuu	seven	87	Oromo	derivation	push in
orthographic	daamessa	Eight	84	Oromo	Derivation	cloud
orthographic	dhabbataa	seven	90	Oromo	derivation	stable
orthographic	giraasoo	Eight	100	Oromo	creolization	grease
orthographic	gonkumaa	seven	120	Oromo	derivation	absolutely
orthographic	guuala	seven	120	Oromo	clipping	acceleration
orthographic	kennamaan	seven	42	Oromo	derivation	given
orthographic	miiliigiraamii	seven	13	English	borrowing	milligram
orthographic	miiliigiraama	seven	13	English	borrowing	milligram
orthographic	pilaneetoota	seven	24	English	borrowing	planets
orthographic	qabaneessuu	Eight	101	Oromo	derivation	condensing
orthographic	gololee	Eight	63	Oromo	Derivation	ring
orthographic	cararaa	seven	120	Oromo	borrowed	beam of light
orthographic	hurufa	seven	23	Oromo	coinage	mud
orthographic	kaarantii	Eight	15	English	borrowing	current
orthographic	kannamaa	seven	30	Oromo	derivation	given
orthographic	radiyeesii	seven	7	English	borrowing	radius

orthographic	satalaaytoota	Eight	17	English	borrowing	satellites
orthographic	siriingaa	seven	92	English	borrowing	syringe
orthographic	vidiyoo konfiransii	Eight	66	English	borrowing	video conference
orthographic	shuboo	Eight	27	Amharic	borrowing	wire
<b>D6.problems of motivation</b>						
motivation	hadiida	seven	120	Oromo	extension	steel
motivation	hollannaa	seven	121	Oromo	derivation	vibration
motivation	konkolaataa	seven	1	Oromo	derivation	car
motivation	marsaa	Eight	77	Oromo	Derivation	orbit
motivation	sissinee	Eight	7	Oromo	coinage	temporary
motivation	utubaa	Eight	102	Oromo	derivation	tower
motivation	waldaya	Eight	102	Oromo	derivation	junction
<b>D7.problems of transparency</b>						
transparency	hima walqixaa	Eight	101	Oromo	compounding	equation normal reaction
transparency	humna mormi ijaajoo	Eight	101	Oromo	compounding	force
transparency	seera maagneetizimii	Eight	5	English	Hybridization	magnetic rules
transparency	walitti kiyyesuu	seven	45	Oromo	compounding	attaching
transparency	diriirsuu	Eight	100	Oromo	derivation	derive
transparency	maagneetizimii	seven	1	English	borrowing	magnetism
transparency	dabarsuu	Eight	13	Oromo	derivation	transmitter
transparency	booca sirnaawaa	seven	15	Oromo	loan translation	uniform shape
transparency	kaappasitaroota	Eight	67	English	borrowing	capacitors
<b>D8.problem of synonymy</b>						
synonym	ariti walfakkaataa	seven	119	Oromo	loan translation	uniform velocity
synonymy	addressa	Eight	83	Oromo	derivation	moon
synonymy	baatii	Eight	95	Oromo	derivation	moon
synonymy	garaabaa	Eight	95	Oromo	derivation	moon
synonymy	ji'a	Eight	83	Oromo	coinage	moon
synonymy	hidha qixxaataa	seven	121	Oromo	compounding	equator
synonymy	sabbata lafaa	seven	121	Oromo	compounding	equator
synonym	bikuu	Eight	100	Oromo	derivation	measure
synonymy	safara	seven	6	Oromo	derivation	measure
synonymy	faaggaa	seven	122	Oromo	coinage	bugle
synonymy	xurumbaa	seven	122	Oromo	derivation	bugle
synonymy	waldorgomsiiisu	seven	6	Oromo	derivation	comparison
synonymy	walitti akeeku	seven	6	Oromo	compounding	comparison
synonymy	konkolaataa qotisaa	seven	82	Oromo	compounding	tractor
synonymy	tiraakteera	seven	1	English	borrowing	tractor
synonymy	daandii sirrii	seven	30	Oromo	loan translation	straight road
synonymy	karaa qajeelaa	seven	30	Oromo	compounding	straight road
synonymy	duumessa	Eight	84	Oromo	Derivation	cloud
synonymy	daameesa	eight	84	oromo	derivation	cloud

synonymy	suudoowwan	Eight	11	Oromo	derivation	particles
synonymy	paarikiloota	Eight	11	English	borrowing	particles
synonymy	telefoona	even	2	oromo	borrowing	telephone
synonymy	bilbila ammayaa bilbila gurratti	seven	2	oromo	extension	telephone
synonymy	qabatan	Eight	45	Oromo	compounding	telephone
synonymy	yunivarasii	Eight	82	English	borrowing	univerese
synonymy	hawaa	Eight	82	Oromo	coinage	universe
<b>D9.problems of polysemy</b>						
polysemy	ba'aa	seven	64	Oromo	Derivation	weight
polysemy	ba'aa	Eight	100	Oromo	derivation	tolerance
polysemy	dandeetti	seven	48	Oromo	Derivation	ability
polysemy	dandeetti	Eight	100	Oromo	derivation	capacity
polysemy	deebii	seven	43	Oromo	derivation	answer
polysemy	deebii	seven	43	Oromo	derivation	solution
polysemy	dhaabbataa	seven	23	Oromo	derivation	non motional
polysemy	dhaabbataa	seven	18	Oromo	derivation	uniform
polysemy	qaama	seven	14	Oromo	derivation	object
polysemy	qaama	seven	20	Oromo	derivation	body measurable things
polysemy	qaamoole safarmoo	seven	6	Oromo	compounding	things
polysemy	qaxxaamura	Eight	26	Oromo	blending	cross section
polysemy	qaxxaamura	seven	6	Oromo	extension	displacement
polysemy	shallagu	seven	15	Oromo	derivation	calculate
poplysemy	shallagu	seven	83	Oromo	derivation	examine
polysemy	tilmaamu	seven	10	Oromo	derivation	plan
polysemy	tilmaamu	seven	122	Oromo	derivation	guess
polysemy	safara dhaabbataa	seven	6	Oromo	compounding	uniform measure
polysemy	rigata dhaabbataa	Eight	101	Oromo	derivation	static friction
polysemy	handhuura	Eight	83	Oromo	extension	nucleus
polysemy	nikulasii	Eight	83	English	Borrowing	nucleus

### **DECLARATION**

I here declare that this thesis is my original work and has not been presented for a degree in any other university, and that all sources of materials used for the thesis have been duly acknowledged.

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Date: \_\_\_\_\_

This thesis has been submitted for examination with my approval as a university advisor.

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Date: \_\_\_\_\_

