



## Composing Radiographic Dictionary for Radiology Students and Radiographers

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### Abstract

The rapid development of science and technology on radiology requires radiology students in particular and radiographers in general to be able to understand and master the science and technology through books or scientific articles, which are mostly written in English. To help them understand the radiological scientific information easily, a complete basic terminologies dictionary on radiology is needed. This study aimed to identify, classify, and describe the vocabularies contained in Textbook of Radiographic Positioning and Related Anatomy linguistically which then are translated into *Bahasa Indonesia* and compiled into a radiological pocket dictionary. This research used qualitative method. Data in the form of vocabulary list were taken from the textbook by the help of AntCont. This research went through 7 stages of activities which include syntactic, morphological, semantic, and phonetic analysis. In addition, the vocabularies then had passed 2 stages of evaluation to check the spelling, meaning, and transcription of the words. Furthermore, the dictionary draft contains the use of the vocabularies in sentences in the context of radiology. Results of the study in the form of a pocket dictionary draft consisting list of basic radiological vocabulary/terms accompanied by the syntactic categories, the meaning of words in Indonesian language that are in accordance with the scientific context of radiology, phonetic transcription, and examples of the use of words in sentences in the context of radiology are expected to contribute to improving the quality of human resources of radiographers in Indonesia.

*Keywords:* Linguistics, pocket dictionary, radiology

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### 1. Introduction

Since the discovery of X-rays by Prof. Willem Conrad Roentgen in the late 1895, the radiological science and technology continues to grow rapidly throughout the world. Various trends, methods, and innovations of more sophisticated radiological equipment were developed in order to assist easier and more accurate radiological examinations. As one of developing countries, Indonesia must follow the development and trends. However, in addition to following the development of sophisticated radiological science and technology, Indonesia must also prepare human resources in the field of radiology who in this regard refer to competent and qualified radiographers understanding the basic terms and have a good knowledge of the subject and technology in radiology as well as having international competitiveness.

To produce the graduates who understand and master the radiological science and technology and have international competitiveness, it is necessary to have worldwide learning resources. The limited Indonesian learning resources in radiology have forced the Radiology Study Program to use English textbooks. Therefore, to understand the textbooks, students should have the ability of English Language. Unfortunately, the students' ability in English is still low (Guthrie, 2009) resulting in an obstacle for students to understand radiological knowledge comprehensively. According to some previous research, the low ability of English is mainly due to inadequate vocabulary mastery (Alqahtani, 2015). Vocabulary is very important in mastering reading, listening, speaking, and writing skills (Fitria, 2022). As a consequence, students and radiographers must have a reference containing a list of vocabularies or terminologies which are used in the field of radiology in the form of a pocket dictionary. The availability of the pocket dictionary is expected to accelerate the improvement of the English skills of radiology students in particular and radiographers in general so they can easily understand radiological texts

## 2. Literature Review

Knowing the meaning or definition of new vocabulary easily and in accordance with the specific science is an activity that really supports the success of student learning using books or reference sources in foreign languages. To get information about a word lexically and grammatically, the bilingual dictionary being the only reference used by language learners to be able to master and understand deep foreign language vocabulary. Bilingual dictionaries generally contain explanations of the meaning of vocabulary and its use in the target language accompanied by information about word classes and pronunciation in the source language. However, the meaning of the word is found in the available bilingual dictionaries usually general and neutral. As consequence, the dictionaries often cannot facilitate the needs of dictionary users or students in certain fields such as students in radiology study program and radiographer profession.

Various studies related to dictionaries can be grouped by topic into 3 groups: the urgency of having a dictionary, the process of making a dictionary, and the use and composition dictionary. The urgency of compiling a dictionary by linguists, in this case lexicographers, is seen from various perspectives and interests as well as benefits to be obtained. In learning English, a dictionary will be needed when you find a word that looks familiar but it is used in a different broader sentence or even more specific which makes the meaning seem ambiguous (Hakim et al., 2018). Of the benefits, the existence of a dictionary becomes part of a potential learning strategy in developing the learning process (Rohmatillah, 2016). The existence of electronic dictionaries as a result of technological developments is a complement to printed dictionaries but the results of learning using different dictionaries actually show certain phenomena (Hakim et al., 2018).

The process of compiling a dictionary begins with the preparation of data containing information to be shared with other researchers (Buchaban et al., 2021). Then move on to the stage of analyzing the meaning of words in the preparation of the dictionary. In addition to the process of making a dictionary, it turns out that there are also internal yin and yang factors in dictionary creation that happened to lexicographers in Slovenia (Vrbinc et al., 2021).

The use of dictionaries in various grades and activities showed varying impacts. On students at MTs. Al-Musthafa the use of printed dictionaries did not show significant impact on developing student vocabulary (Uswahsadieda et al., 2020). While the use of online dictionaries for deaf people in reading comprehension to learn new vocabulary was more in demand than printed dictionaries (Hakim et al., 2018). However, there is also phenomenon that some of students do not know how to use dictionaries quickly and maximally.

Specific bilingual dictionaries found in scientific articles include medical dictionaries, learner's dictionaries such as oxford learner's dictionary, dictionary of laws such as law dictionary, dictionary of Qur'anic vocabulary, dictionary of development terms areas issued by the Regional Infrastructure Development Agency of the Ministry of Works Public and Public Housing, Dictionary of Indonesian Signing System (SIBI), and Dictionary for tourism such as A Dictionary of Travel and Tourism, which are available online at their websites mentioned in references.

Of all the research activities that have been carried out by the researchers and lexicographers above, there are some points to consider that:

- a) The dictionaries used in the research above are general bilingual dictionaries and are not specific dictionaries to a particular field.
- b) Not all processes of compiling the dictionaries used corpus as a data preparation tool.
- c) Research on producing a list of basic radiology vocabularies for radiology students in Indonesia has not been found.

## 3. Materials and Methods

### 3.1. Materials

Data were taken from a 830-pages-Textbook of Radiographic Positioning and Related Anatomy that is used during the study in Radiology Study Program. The book consists of comprehensive text focusing on nearly 200 of the most commonly requested projections to ensure students master what is expected of an entry-level practitioner. To generate words in the book into list of vocabularies, AntCont was used. AntConc is a free corpus analysis software that can easily help to identify patterns in a collection of texts. Dictionaries, such as English Indonesian dictionaries or English dictionaries were used to give transcription and meaning in source and target language.

### 3.2. Methods

The method used in this study was qualitative method by adapting the 4-D model (Define, Design, Develop, dan Disseminate) proposed by Thiagarajan in Le Serrec et al. (2010). Research data is a list of vocabularies resulting from the data was obtained by the help of linguistic corpus observing the frequency of words occurrence in the textbook.

In this study, words on the list passed through 7 stages of the research including linguistic data analysis at the syntactic level through analysis of word class categories, morphological level to see word formation, semantic analysis to identify lexical and grammatical meaning of the vocabulary and to get equivalent words in Indonesian in accordance with the scientific context of radiology, and phonetic transcription to help provide an overview of how to

pronounce the words in accordance with the source language. Besides that, the vocabularies will then go through 2 stages of evaluation to check the spelling of the written words, word meanings, transcription, and sentence examples given in the pocket dictionary as shown in Figure 1.

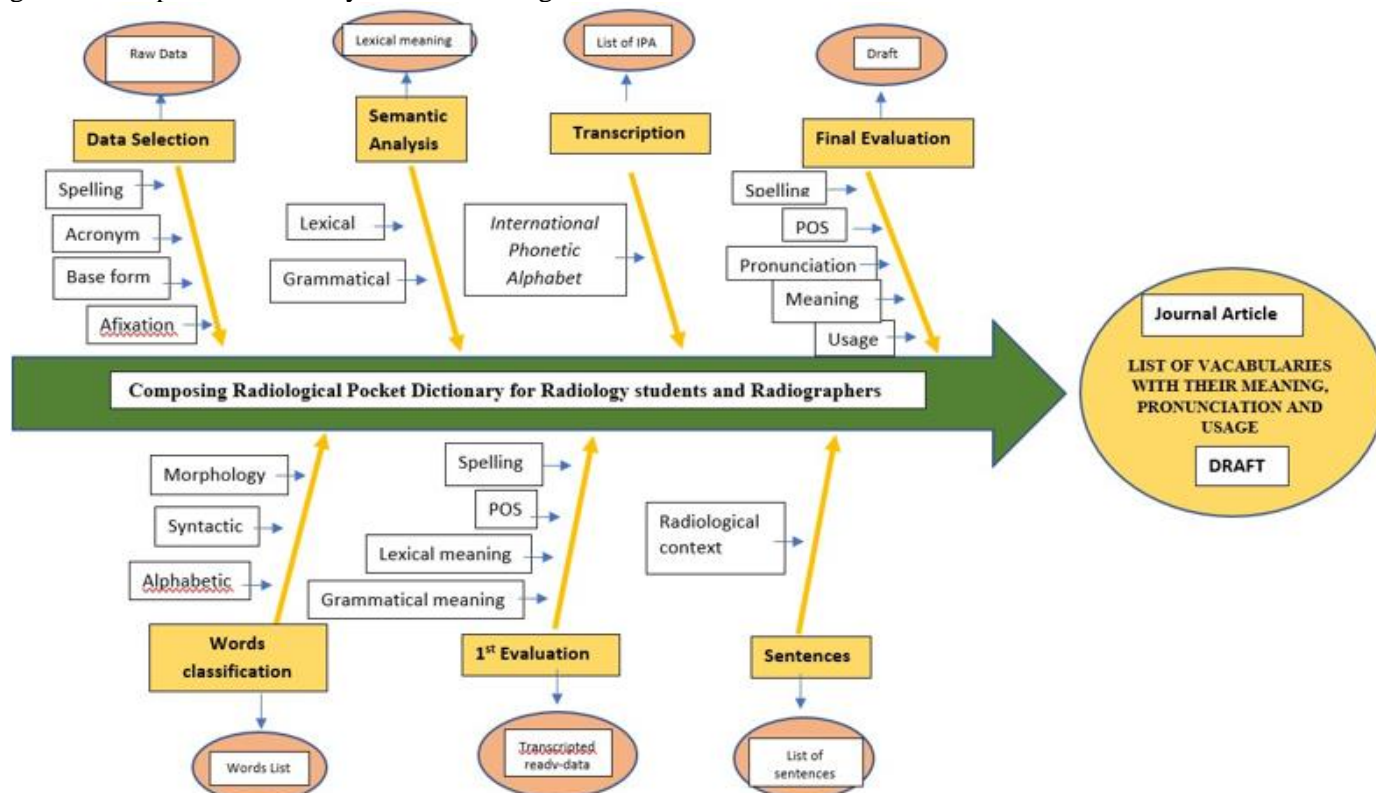


Figure 1: Research Flow Chart

Figure 1 shows the flow of linguistic analysis performed in compiling a radiological pocket dictionary of English-Indonesian in a year which includes the stages of activities in detail; title of activities, data analyzed, and indicators of activity results at each stage. Processes of the words analysis are divided into 7 stages of activities involving linguistic analysis at the level of syntax, phonology, morphology, and semantics.

a) Data selection

At this early stage, the list of vocabulary resulting from AntCont will be selected by separating groups of base form words, words with affixes, closed words, and abbreviations. At this stage the writing of vocabulary was also checked to ensure the correct spelling of the words. When finished, then the data for each group of words is sorted alphabetically.

b) The activities carried out in stage 2 are analyzing words syntactically and morphologically. From this analysis syntactically we will get word classes for each root word and affixed words. Besides that at this stage, the word with affixes will be placed adjacent to the base word to make it easier for dictionary users to get the word derivative of the root word it is looking for.

c) Semantic analysis of data was carried out lexically and grammatically. It was performed by looking at the meaning of the word in isolation and meaning in sentence to get the exact translation word that matches radiology context. In the process of finding equivalent words in the target language (Indonesian) researchers took reference sources from qualified international dictionaries such as Oxford Dictionary, Merriam-Webster Dictionary, and Medical Dictionary as well as an English-Indonesian bilingual dictionary and the online Indonesian Language Dictionary (KBBI, 2016). Furthermore, to be sure of the validity of the equivalent words used in the translation process, the researchers had collaborated with lecturers and practitioners in the radiology study program. Meanwhile, for the list of acronyms, they were searched in the textbook itself and searching from the internet.

d) After being given the appropriate word translation in Indonesian Language, the first evaluation was carried out in collaboration between the chairman and members of the research to check if there are errors in the processes before hand as well as prepare data for the next stage, namely the phonetic transcription process.

e) In the phonetic transcription process, the vocabularies that have been given their translation in Indonesian Language will be given their phonetic transcription which is guided by the International Phonetic Alphabet (IPA) which is literally widely used by lexicographers in compiling dictionaries and is available online. The result of this

stage is a phonetic transcription of each vocabulary that serves as a guide dictionary users in pronouncing the word correctly according to the rules of the source language.

f) Examples of the use of words in English sentences will be given according to the scientific context radiology and preferably taken from Bontrager's book and other radiology scientific sources.

g) The final evaluation is a closing activity where at this stage the list of words/terms has been completed passing the activity stage 6 will be examined starting from spelling, word classes, pronunciation and examples of the use of words in English to the meaning/ meaning of words in Indonesian.

The series of stages of linguistic analysis of the list of words/terms in the preparation of this dictionary ends. List of words that have received phonetic transcriptions, word classes, equivalents in Indonesian, examples of sentence containing the word will then become the main content of the dictionary draft for radiology students and radiographers.

#### 4. Results and Discussion

Draft of the radiological dictionary provides vocabularies concerning to the information on general and specific anatomy needed in radiography and how to use positioning that covers information on clinical indications, projection summary, technical factors, image receptor icon, shielding, patient position, part position, central ray, recommended collimation, respiration, evaluation criteria, positioning photograph, radiographic image, and anatomy overly image.

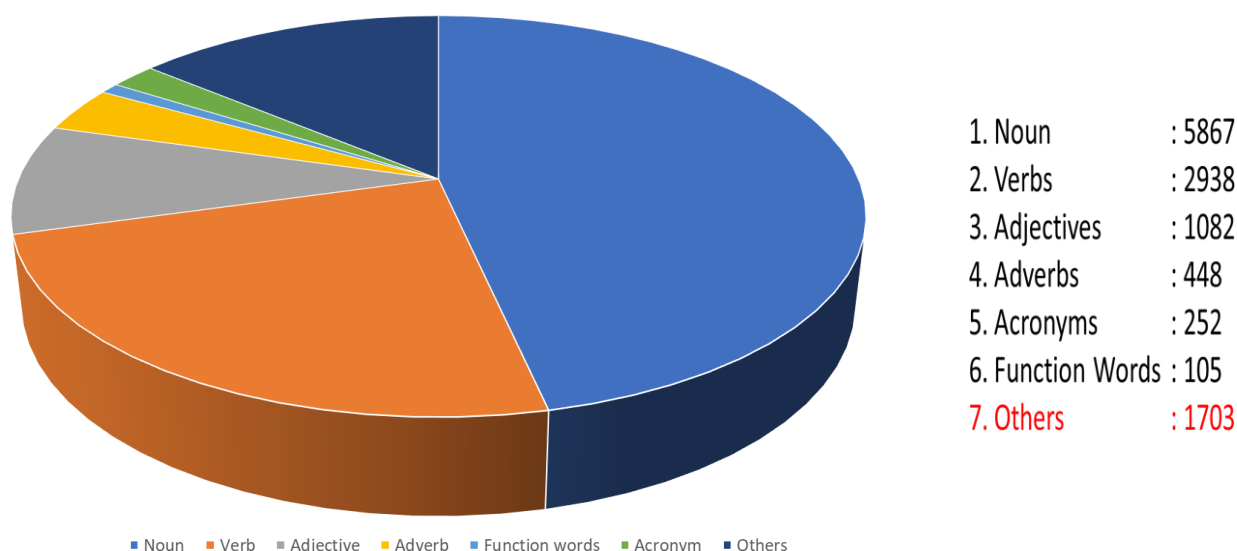


Figure 2: Results of the data selection process

Results of the AntCont show that the book is composed of 12395 types of words with the total words of 428117 including the repeated words mentioned in the textbook. The words classified are open words of 5867 nouns, 2968 main verbs, 1082 adjectives, 448 adverbs, and 252 acronyms, as well as 105 function words. Among them there are 1703 words categorized as others consisting of syllables, which are uncomplete words, and numbers. All open words are written in the base and affixed forms of words.

Each word is written in its base form and is placed side by side with its derivation. It will help students or dictionary users to be more aware with vocabularies regarding to the word formation of the word. Users will unconsciously learn the morphological process by looking at the marker added in a base form a word. The morphological process will also affect syntactic categories by changing their word classes. Semantically, the morphological process also takes a part in translating words from the source language to the target language. Furthermore, the addition of word usage in sentences shows user how the word is used in the context of radiology. The following figure gives the example of a word with its derivational.

1973	differ	VERBA DASAR	berbeda	'difer
1974	difference	NOMINA/KATA BENDA	perbedaan	'diferəns
1975	differences	NOMINA/KATA BENDA JAMAK	perbedaan	'diferənsiz
1976	differential	AJEKTIVA/KATA SIFAT	menunjukkan hal yang berbeda	'dife'renʃəl
1977	"diferensial"	ADVERBIA/KATA KETERANGAN	hal yang berbeda	'diferənʃəl

**Figure 3:** Samples of the word ‘differ’ and its derivation, part of speech, meaning in Indonesian language, and transcription.

Based on the form of the verb found in the book, the draft will also include grammatical information concerning to the verb form. The draft also provides information about the verb form which is closely related to the active and passive voice, as well as tense and adjective clause. Therefore, users will not only know the meaning of a word in isolation and how to pronounce it but they also will know how to identify the word classes, active or passive form, and its tenses.

## 5. Conclusion

The availability of radiological textbook dictionary is a must and should be able to assist radiology students in particular and radiographers in general to upgrade their knowledge on updated radiography examination along with its technology and science.

The specific objective of this research is to produce quality and superior Indonesian radiographers as well as having international competitiveness with good English skills. Results research in the form of a list of basic radiology vocabulary/terms accompanied by syntactic categories, the meaning of words in Indonesian that are in accordance with the scientific context of radiology, transcription phonetics, examples of the use of words in sentences in the context of radiology will contribute to improving the quality of human resources in the field of radiology (radiographers).

Having the vocabulary and grammatical knowledge, they will understand not only the radiography textbook but also radiological journal articles and other sources. Moreover, users are also able to use the vocabularies in written and spoken communication concerning to radiography field at particular.

However, further research is needed to develop the printed dictionary into digital dictionary which will ease the users to find words through their fingers on the gadget

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