

## Implementing Annotation Strategies in Reading Scholar Articles Prototype

### Implementasi Strategi Anotasi dalam Prototaip Pembacaan Artikel Ilmiah

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#### ABSTRACT

This study explores the issue of annotation strategies and types used by researchers when reading scholarly articles during research activities. Researchers are active readers who make annotations when reading scholarly articles. Annotation types, such as highlight, underline, comment, and writing keywords, are often found in researchers' annotated articles. Previous studies have shown that researchers forgot their intention after annotation, and their annotations were incomplete, resulting in a loss of value. We begin by designing early annotation strategies and types based on a literature review. We conducted an observation and interview session to verify the proposed annotation strategies and types, including collecting feedback from the researchers. A prototype was built and tested by 38 researchers during an evaluation session. The results showed that researchers have their annotation strategies and types when reading scholarly articles. They accepted the proposed annotation strategies and types and found them useful, meaningful, and usable.

**Keywords:** Active reading, annotation strategies, annotation, annotation types, prototype

#### ABSTRAK

Kajian ini meneroka isu strategi anotasi dan jenis anotasi yang digunakan di kalangan penyelidik apabila membaca artikel ilmiah sepanjang aktiviti penyelidikan. Penyelidik adalah pembaca aktif yang membaca dan membuat anotasi semasa membaca artikel ilmiah. Jenis anotasi seperti penyerlah, garis bawah, komen dan menulis kata kunci sering dijumpai dalam artikel penyelidik. Kajian terdahulu menunjukkan bahawa penyelidik lupa niat asal mereka membuat anotasi, anotasi mereka tidak lengkap dan mengakibatkan anotasi tersebut hilang nilainya. Metodologi kajian ini dimulai dengan mereka bentuk strategi anotasi awal dan jenis anotasi berdasarkan kajian literatur. Diikuti dengan pengesahan strategi dan jenis anotasi melalui kaedah pemerhatian dan temuduga serta mengumpul maklum balas daripada penyelidik. Seterusnya pengujian dijalankan terhadap 38 orang penyelidik sebagai responden melalui prototaip yang dibina. Hasil analisis menunjukkan bahawa penyelidik mempunyai strategi dan jenis anotasi mereka sendiri apabila membaca artikel ilmiah. Mereka menerima strategi anotasi dan jenis anotasi yang dicadangkan dan mendapati ia berguna, bermakna, dan boleh digunakan.

Kata kunci: Pembacaan aktif, strategi anotasi, anotasi, jenis anotasi, prototaip

## INTRODUCTION

Annotation is a common active reading activity comprising the researcher's personal comments and their thoughts on an article or document. According to Vaganova et al. (2020), research activities can enhance a person's capacity for information selection and analysis as well as their ability to think creatively in solving problems. One such research activity is active reading. Researchers have actively identified useful and potential information that can support their purpose of reading (Bélangier 2010; Furuta et al. 2002; Long et al. 2020; Masharipova & Mizell 2021) in order to produce high-quality scientific articles (Hood & Sahari@Ashaari 2013). Golovchinsky (2008) mentioned that active reading at work is annotation, quoting, comparison, searching, note-taking, and sharing. Annotation is a popular active reading strategy that encourages readers to engage deeply with the text using highlighters (Nelson 2019; Porter-O'donnell et al. 2004; Wolfe 2000). Annotations are created and manipulated using different strategies, according to the content of the reading material (Ovsiannikov et al. 1999). Most personal annotations are telegraphic, incomplete, and implicit (Marshall 1998). Reading annotation strategies require the reader to annotate by highlighting, underlining a specific sentence in a paragraph, and jotting (Hunsinger 2021) personal content to the text (Keith 2021, Sacchi 2011) to gain a full understanding of what is read (Nesrine 2021).

The meaning of the annotation is often misleading, and annotators forget their intention to mark (Schilit et al. 1998). Stored and annotated papers lose value after they are completed (Marshall and Ruotolo 2002). Another annotation strategy issue is the lack of cognitive strength to read with a purpose and understand complex materials (Zebbouchi et al. 2021). Most of the problems are related to annotation usage, for example, "how to use a specific annotation" and "which annotation to use", which may result in difficulties and even defects in annotation usage (Liu et al. 2022).

O'Hara (1996) mentioned that readers usually choose appropriate activities (i.e., underline, take notes, and outline) according to the constraints of manipulation and the chosen reading medium to achieve the reading goal. Researchers read journal articles by first observing the journal's list of contents as a preliminary consideration of its usefulness. If an article is selected, the reader then turns to the page and assesses the quality of the article based on the author's academic institution. After that, the abstract was read either fully or with just skimming. The researcher quickly scanned the entire article. This navigation was intended to provide more information about the content of the article. The title of the article is also browsed at this stage, along with a scan of the article diagram and table. Inference skimming is another common method for extracting the main ideas from an article. References were also read to examine the relevance of other articles. Ultimately, the researcher decides whether to continue referring to the article or vice versa.

This study aims to identify annotation strategies and annotation types for reading scholarly articles and evaluate annotation strategies and types using a prototype. The next section discusses the related work, methodology, prototype, results, discussions, and conclusions.

## ANNOTATION STRATEGIES

Readers' annotation strategies often change, and the symbols or types of annotations are inconsistent. They tend to forget the intentions and purpose of their annotations (Schilit et al.

1998). According to Roy et al. (2021), active reading strategies such as content annotations (using highlighting), writing keywords, taking notes, and reflections have been shown to increase learners' knowledge and understanding of the topics being explored. This is particularly significant in the case of long and complex learning.

The annotation strategies identified in previous studies include layout (O'Hara & Sellen 1997; Schilit et al. 1998), highlight (Bélanger 2010; Chauhan & Seriani 2019; Hunsinger 2021, Roy et al. 2021; Shukla & Chaudhary 2012; Tashman & Edwards 2011), underlining (Bélanger 2010; Chauhan & Seriani 2019; Hunsinger 2021; Shukla & Chaudhary; 2012), comments (Bélanger 2010; Chauhan & Seriani 2019; Gruenstein et al. 2008; Gunawardena et al. 2010; Hunsinger 2021), writing keywords (Roy et al. 2021), outlining (Morris et al. 2007), taking notes (Bélanger 2010; Krishna et al. 2019; Roy et al. 2021; Shukla & Chaudhary 2012), comparing (Carroll 2020; Tashman & Edwards 2011), developing new knowledge (Inie & Barkhuus 2021; Roy et al. 2021; Thayer et al. 2011), update existing knowledge (Roy et al. 2021; Thayer et al. 2011), add value (Ruvane 2005), add vocabulary (Gruenstein et al. 2008; McWhorter & Sember 1994), re-evaluate (Aubert & Prié 2005; Collins 1993; G'ayratovna 2022), extracting the content (O'Hara 1996; Thayer et al. 2011), navigate (Dobbie et al. 2021; Nghiem et al. 2021; Seatter 2019), searching (Ji et al. 2018; Kim et al. 2019; Neves & Ševa 2021), reflections (Roy et al. 2021), ask questions (Gruenstein et al. 2008; Ko et al. 2020; Marashi & Mirghafari 2019; Shibani et al. 2022), and re-read the sentence, mark the confusing sentence, list the supporting sentences, and check the important passage (Gruenstein et al. 2008).

According to Kazai et al. (2008), further research is needed to explore reader practices and to produce a set of guidelines for software that supports different reader activities during reading and writing. Annotation strategies support the annotator's understanding while reading articles. It can be generic or specific, according to the purpose of reading (Furuta et al. 2002; Long et al. 2020; Masharipova & Mizell 2021; O'Hara 1996). Table 1 shows the compilation of annotation strategies from previous studies.

#### ANNOTATION TYPES

The process of contextualizing and synthesizing ideas is aided by highlighting and writing notes, which leads to interactive reading (Azmuddin et al. 2020).

The identified annotation types from previous studies have been highlighted (Bélanger 2010; Chauhan & Seriani 2019; Ball 2009; Shukla & Chaudhary 2012; Tashman & Edwards 2011), underlined (Bélanger 2010; Chauhan & Seriani 2019; O'Hara 1996; Shukla & Chaudhary 2012), comment (Bélanger 2010; Gruenstein et al. 2008; Krishna et al. 2019; O'Hara 1996; Shukla & Chaudhary 2012), question mark (Krishna et al. 2019; Shukla & Chaudhary 2012), circle (Baumeister 2015; Chauhan & Seriani 2019; Hemminger & TerMaat 2014; Shukla & Chaudhary 2012), mark (Bélanger 2010; Chauhan & Seriani 2019; Marshall & Ruotolo 2002), an asterisk (Bélanger 2010) and support/additional materials (Krishna et al. 2019).

TABLE 1. Annotation Strategies from Previous Studies

Author(s)	Strategies
O'Hara & Sellen 1997; Schilit et al. 1998	Layout
Bélanger 2010; Chauhan & Seriani 2019; Hunsinger 2021; Roy et al. 2021; Shukla & Chaudhary 2012; Tashman & Edwards 2011	Highlighting
Bélanger 2010; Chauhan & Seriani 2019; Hunsinger 2021; Shukla & Chaudhary 2012	Underlining
Bélanger 2010; Chauhan & Seriani 2019; Gruenstein et al. 2008; Gunawardena et al. 2010; Hunsinger 2021	Comments
Roy et al. 2021	Writing keywords
Morris et al. 2007	Outlining
Bélanger 2010; Krishna et al. 2019; Roy et al. 2021; Shukla & Chaudhary 2012	Taking notes
Bélanger 2010; Carroll 2020; Tashman & Edwards 2011	Comparing
Inie & Barkhuus 2021; Roy et al. 2021; Thayer et al. 2011	Developing new knowledge
Roy et al. 2021; Thayer et al. 2011	Update existing knowledge
Ruvane 2005	Add value
Gruenstein et al. 2008; McWhorter & Sember 1994	Add Vocabulary
Aubert and Prié 2005; Collins 1993; G'ayratovna 2022	Re-evaluate
O'Hara 1996; Thayer et al. 2011	Extracting the content
Dobbie et al. 2021; Nghiem et al. 2021; Seatter 2019	Navigate
Ji et al. 2018; Kim et al. 2019; Neves & Ševa 2021	Searching
Roy et al. 2021	Reflections
Gruenstein et al. 2008; Ko et al. 2020; Marashi & Mirghafari 2019; Shibani et al. 2022	Ask questions
Gruenstein et al. 2008	Re-read the sentence, mark the confusing sentence, list the supporting sentences, check the important passage

Generic annotation types are listed in Table 2. It can be used by any annotator when reading any material. Annotation types are in the form of text, symbols, and objects (Mostefai et al. 2010), and are found in printed paper (Kirwan 2009; Long et al. 2020; O'Hara & Sellen 1997) or digital documents (Long et al. 2020; O'Hara & Sellen 1997; Schilit et al. 1998; Shukla & Chaudhary 2012).

Table 2 shows that highlights and underlines are described as important and relevant information. Comment has a few descriptions that are (i) opinion, (ii) understanding the content of the text more deeply, (iii) content and linkages, restructuring to create a new order specific to the objectives, and (iv) general information about the article or information about part of the article. Question marks were described as fallacies, doubts, or questions about the entire article or a part of the article. Circles were keywords, doubts, or mistakes (Shukla & Chaudhary 2012). Support/additional materials were links to external resources, such as blogs, videos, and other articles. The description of the marks and asterisks is not mentioned.

TABLE 2. Generic Annotation Types

Annotation Type	Description	Author(s)
Highlight	Keywords, doubts, and mistakes.	Bélanger 2010; <b>Chauhan &amp; Seriani 2019</b> ; Ball 2009; <b>Shukla &amp; Chaudhary 2012</b> ; Tashman & Edwards 2011
Underline	Important and relevant information.	Bélanger 2010; Chauhan & Seriani 2019; <b>O'Hara 1996</b> ; <b>Shukla &amp; Chaudhary 2012</b>
Comment	Description or opinion. Understand the content of the text. Content and linkages. Restructuring to create a new order specific to the objectives. General information about the article or information about part of the article.	Bélanger 2010; Gruenstein et al. 2008; Krishna et al. 2019; O'Hara 1996; Shukla & Chaudhary 2012
Question Mark (?)	Fallacies, doubts, and questions about the whole article or part of the article	Krishna et al. 2019; Shukla & Chaudhary 2012
Circle	Keywords, doubts, and mistakes.	Baumeister 2015; Chauhan & Seriani 2019; Hemminger & TerMaat 2014; <b>Shukla &amp; Chaudhary 2012</b>
Mark	Not mention	Bélanger 2010; Chauhan & Seriani 2019; Marshall & Ruotolo 2002
Asterisk	Not mention	Bélanger 2010
Support/additional materials	Links to external resources such as blogs, videos, other articles and so on	Krishna et al. 2019

Gruenstein et al. (2008) suggested some other info that needs to be annotated before and while reading are titles, subtitles, illustrations, text formats (bold, italic, underline), who, where, when, vocabulary, important ideas, writing a brief definition (as "Def") and the main term.

The reader also needs to identify annotation types such as a) bibliographic entries, b) authorities and feasibility, c) principal spades and objectives, d) anything biased, e) related to other studies in the same field, f) findings/results, and g) conclusions. In addition to the bibliographies. Annotations must contain important details such as glossaries/indices, questionnaire instruments, tested tools, and others (Leonard 2019).

Both Gruenstein et al. (2008) and Leonard (2019) suggested an annotation type suitable for researchers reading scholarly articles. We outline an annotation strategy consisting of annotation types for reading scholarly articles, which will be discussed as a result of the implement the annotation strategies and annotation types in a prototype section.

## ANNOTATION TOOLS

According to Heinrichs et al. (2010), when reading using digital documents, (a) annotations and notes are written in new digital documents and on paper, (b) it is difficult to make annotations in the source document freely, but annotation can be customized into bold, italic, underline, and text box forms, (c) navigation is slow, tiring, and interferes with the concentration of readings, (d) activities cannot be carried out simultaneously, and (e) there is a need to scroll up and down when searching for information.

This study examines the function of annotating scientific articles in pdf format. The annotation tools presented in this review were Adobe Acrobat 9 Pro, Mendeley Reference Manager, and Microsoft Edge. These three tools were selected based on the researcher's preference. It is accessible and can be installed easily by researchers.

Adobe Acrobat 9 Pro (Adobe Help 2022) allows users to open and close a PDF file. The actions that can be performed on the selected text are highlighting, line, strikethrough, copying, and editing (text and image). When a highlighted comment is selected, add a note, change colour, and delete comment functions can also be used. Actions that can be made on the selected image include adding sticky notes, highlighting text, editing text and images, and copying images. Annotations can be printed, saved in the original file, or exported as an fdf file or doc file. Users can choose to display article information and annotation lists.

Mendeley Reference Manager displays comments only, and highlights are not displayed as annotation info. The general note function is an annotation for the same article. The Notebook function is used for the personal records of various documents. The function of the text select tool allows the user to select the text in the document, it can also be used to copy and paste related quotes or use a highlighter. The notes tool can be used to create notes at a specific location in a document, also called sticky notes. The highlight tool can be used to highlight text in a document. The highlighted tool uses any of the colors provided. The list of notes refers to the tab section, where all sticky notes made throughout the document are displayed. The list brings the screen view to the location of the notes in the document when clicked (Mendeley 2021).

Microsoft Edge is the only browser that provides annotation functions such as taking notes, writing, doodles, and highlighting directly on webpages. Such annotations can be saved and shared. Users need to select notes to start adding to the page. The ballpoint function uses a touch screen or mouse to highlight, add notes, and share. The next section discusses the implications of annotation strategies and types for researchers. Table 3 shows three annotation tools (Adobe Acrobat 9, Mendeley Reference Manager, and Microsoft Edge) functions used as guidelines for prototype development.

This study examined the basic functions of annotation software that can support the proposed annotation strategy and types. The next section will discuss the implications of annotation strategies and types for researchers. Annotation software should maintain the relationship between notes and related quotes, and readers should be able to sort, filter, organize, and retrieve their notes.

TABLE 3. Annotation Functions of Adobe Acrobat 9, Mendeley Reference Manager, and Microsoft Edge

Functions	Adobe Acrobat 9	Mendeley	Microsoft Edge
Open & Close the pdf file	✓	✓	✓
Save annotations on the original file	✓	✓	✓
Highlight with color	✓	✓	✓
Underline	✓	✓	-
Add sticky note	✓	✓	-
Add & delete the comment	✓	✓	✓
Export annotations	✓	-	-
Print annotations	✓	✓	✓
Article info	✓	✓	✓
List of annotations	✓	✓	-

## METHODOLOGY

Figure 1 shows the methodology based on the article's objective. We identify articles based on "annotation strategies" as a keyword. A selection of articles was analyzed, and we came up with a list of annotation strategies and types as shown in Table 1 and Table 4.

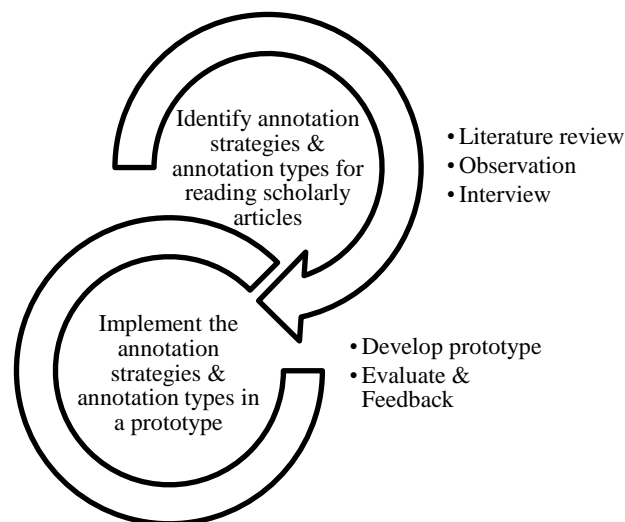


FIGURE 1. Annotation Methodology

A half-day workshop was conducted in a meeting room with eight selected researchers to observe and interview. Starts with a briefing of the workshop, and researchers were supplied with consent documents. Researchers were given two hours to read and annotate their selected scholarly articles. After completion, researchers will be interviewed to get their feedback on the relevance of the given annotation types. Based on the results of this workshop, we developed a prototype as a proof of concept of proposed annotation strategies and annotation types.

A **prototype** was developed using an incremental model (Hinkel 2021; Pressman 2005; Sangeeta Sabharwal et al. 2008; Vorobiova Anna 2021), which implements the verified annotation strategy and the annotation type by eight researchers. The prototype offers functions like opening and closing pdf files, highlighting and adding notes, highlighting and choosing annotation types, exporting annotation only, and saving pdf files with annotation, as shown in Figure 2.

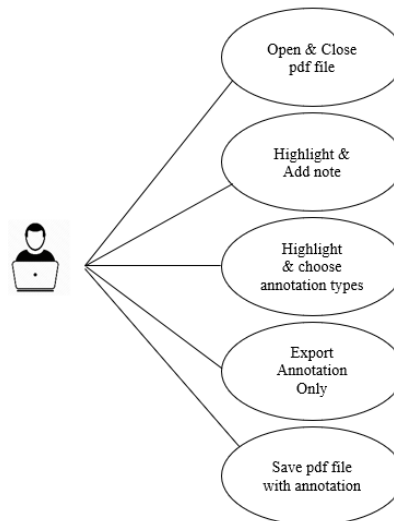


FIGURE 2. Use Case For Prototype

Figure. 3 shows an interface of annotated articles when the save function is selected.



FIGURE 3. Prototype Interface For Save Pdf File With Annotation

Annotating pdf files allows the researcher to highlight the text in the paragraph in the article and select the annotation type that refers to the meaning of the selected text as shown in Figure 4. For example, in the annotation type, the researcher highlights a line of sentences in the first paragraph of the introductory part of the article. Then, a dialogue box will pop up, user then selects Scope as the annotation type, which describes the meaning of the highlighted text.



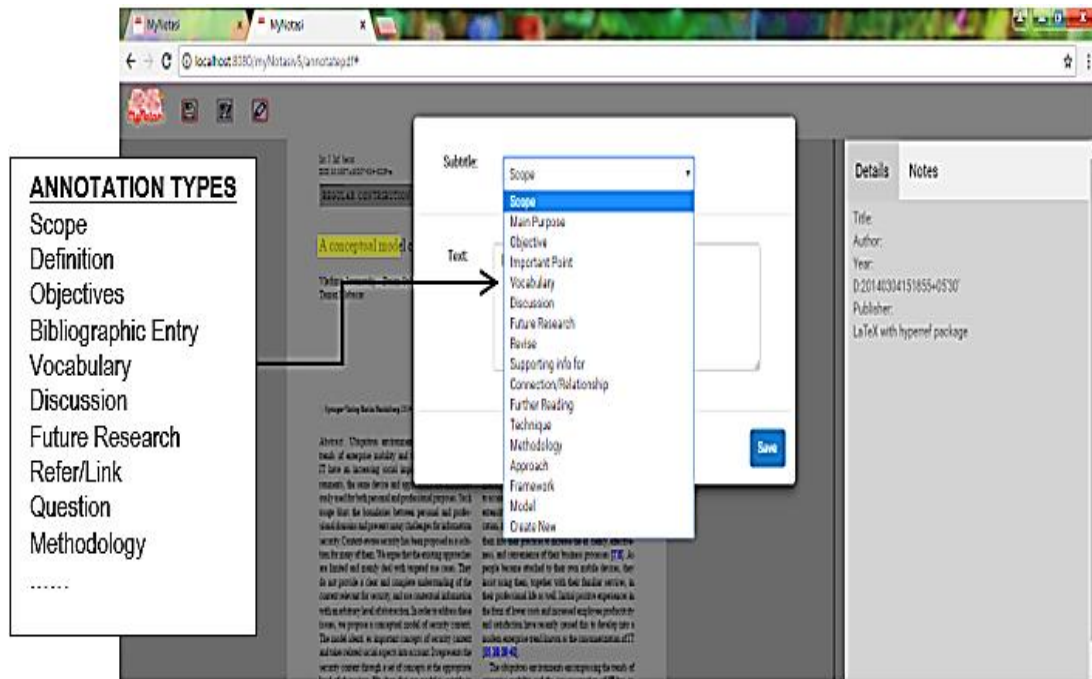


FIGURE 4. Prototype Interface for Annotation Types

The export function is intended to provide researchers with a save and export all the annotations made on the article to a .txt or .docx file into the researcher's personal computer storage, as shown in Figure 5. The save function saves a pdf file that has annotations into the prototype storage.

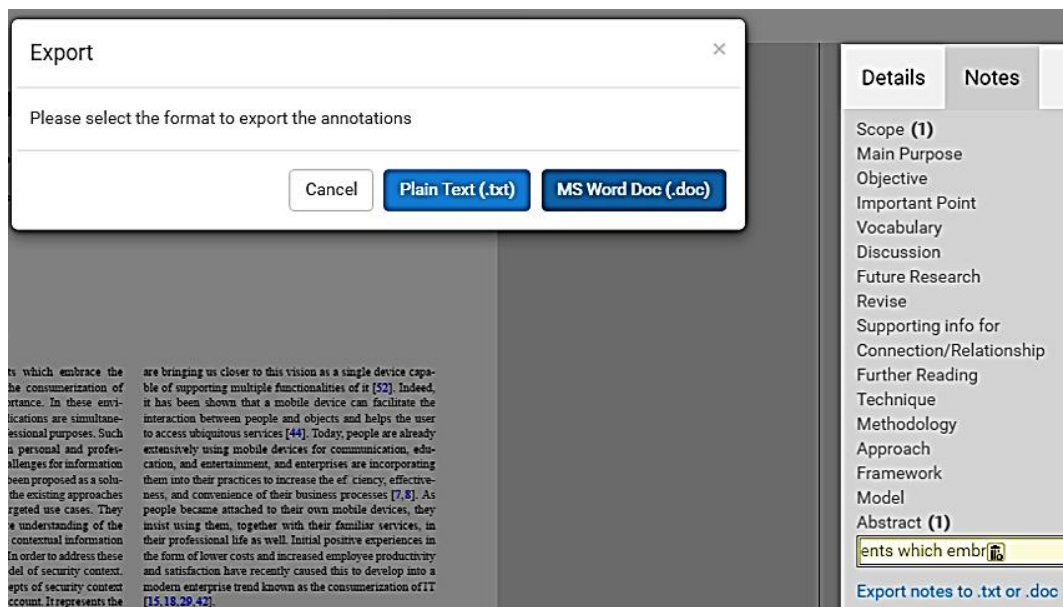


FIGURE 5. Prototype interface for export annotation only as txt or docx file

Figure 6 displays the contents of a text file with all the annotations made by the researcher using the prototype.

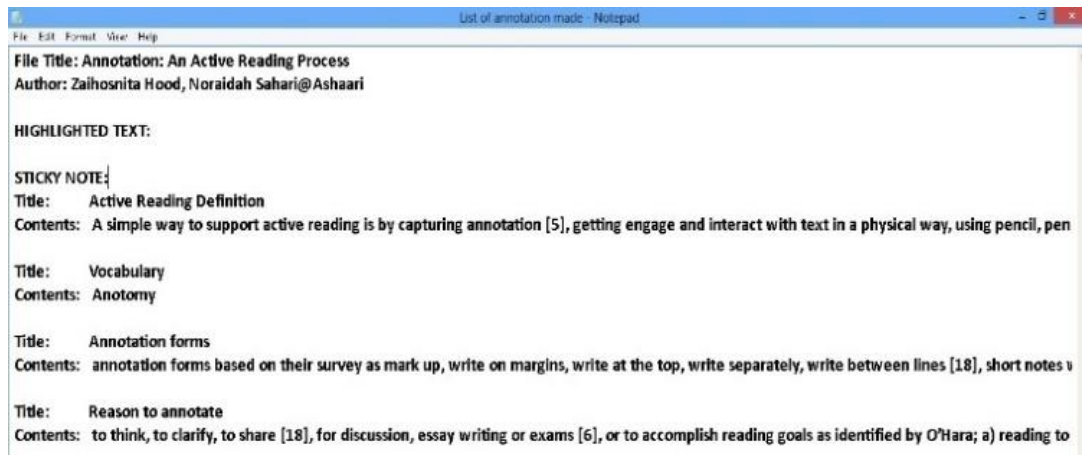


FIGURE 6. Prototype interface for the content of exported txt file

A half-day workshop was conducted in a computer lab to evaluate the usability and acceptance of the proposed annotation strategies and types implemented in a prototype. The tests were conducted on 38 researchers in the computer lab, and the Research Assistant gave a briefing on the purpose and functionality of the prototype. Researchers were supplied with guidelines and tasks as shown in Table 1 and 4. Once the researchers are ready at their respective computers, they can start performing their tasks.

Upon completing the prototype testing, researchers need to fill in an online evaluation of User Interface Satisfaction which was adapted from (Chin et al. 1988) questionnaire for User Interface Satisfaction (QUIS), consisting of six sections, namely screen, terminology, and prototype, prototype learning, prototype capabilities, prototype functionality, and demographics. The questionnaire is built using a five-point scale, strongly agree, agree, neutral, disagree, and strongly disagree (Rabgay 2018). Results of the prototype functionality were reported as mean score interpretation with a scale of 1.00 to 2.33 as low, 2.34 to 3.67 as moderate, and 3.68 to 5.00 as high (Ahmad & Tamuri 2010).

The testing session ends after researchers sign the attendance form for record and token rewards. Some researchers give verbal feedback before the session ends. The results will be discussed in the next section.

## RESULTS AND DISCUSSION

This section will discuss the results of the methodology. The related works on annotation strategies and types from the literature review are explained in the related work section.

Referring to the **literature review** findings, we proposed a list of annotation types with descriptions to researchers, as listed in Table 4. Table 5 shows feedback from the interview session with eight researchers on the proposed annotation types for researchers. Most researchers answered the proposed annotation type as relevant. Annotation types named objective and future research are the most relevant annotation types, with 95% votes. Followed by annotation type named scope and discussion with 92%, definition, key term, and methodology with 89%, supporting info and question with 87%, review with 82%, important passages and refer/link with 79%, bibliography entry, and vocabulary with 76%, the summary is the less relevant with 74% votes.

TABLE 4. Annotation Types for Reading Scientific Articles

<b>Annotation Types</b>	<b>Description</b> (Text, word, sentence, diagram, or table description)	<b>Author(s)</b>
Scope	the scope of the study in the article	Leonard 2019;
Definition	definition of the word	Gruenstein et al. 2008
Vocabulary	words in the article that need to be searched for their meaning	
Objective	the purpose/objectives of the study in the article	Leonard 2019; Engle 2015; Gruenstein et al. 2008
Bibliographic Entry	author name, article title, year of issue, publisher, etc.	Leonard 2019; Gruenstein et al. 2008; O'Hara 1996
Discussion	the study discussed in the article	Leonard 2019
Future Research	future research in the article	
Methodology	methodology to the study stated in the article	
Refer/Link	the reference/link of an article with other articles in the same domain	Leonard 2019; Krishna et al. 2019,
Question (?)	question for further investigation/info on text, words, sentences, diagrams, or tables in the article	Leonard 2019; Krishna et al. 2019; Engle 2015; Shukla & Chaudhary 2012

TABLE 5. Annotation Types Relevant Result

<b>Annotation types</b>	<b>Relevant (%)</b>	<b>Irrelevant (%)</b>
Scope	92	5
Definition	89	8
Objective	95	3
Bibliography Entry	76	21
Vocabulary	76	21
Discussion	92	5
Important Passages	79	18
Future Research	95	3
Refer/Link	79	16
Question	87	11
Methodology	89	8

**Observation** results show researchers read and annotate printed articles (O'Hara & Sellen 1997; Kirwan 2010; Long et al. 2020) using pen, highlighter, and Post-it notes. Researchers also read and annotated articles digitally (O'Hara & Sellen 1997; Schilit et al. 1998; Shukla & Chaudhary 2012; Long et al. 2020) using Adobe Reader software. Researchers search and download scientific articles from Google, Google Scholar, digital libraries, and journal websites. Researchers do not have standard annotation practices or strategies. Their annotations collection was kept as printed copies or digitally often not referred to after being read and annotated (Schilit et al. 1998). There was a time when they didn't understand the intention and

meaning of their annotations and the annotations of other researchers. As a result, researchers find it difficult to reuse and share their annotation collections with other researchers.

Software that is often used to read scientific articles is Adobe Reader and Mendeley Desktop. A comparative analysis conducted by (Jing 2016) shows that Adobe Reader and Mendeley Desktop software provides the function of opening pdf file, saving annotations in the original file, color highlighting, adding comments or notes, list of annotations, article info, and printing annotations in articles. Both software does not provide the function to add a title or header to the highlighted text and export annotation to txt and docx files.

Figure 7 shows the **interview** results of the researcher's active reading management scenario. Researchers searched for articles using a browser through the Google search engine, digital library website, or Google Scholar. The search is done using certain keywords, and after tracing the search results, the researcher will briefly read the article. Articles that are appropriate for the search are then downloaded and printed or stored in the researcher's storage. The downloaded document will be printed before reading. During the reading process, the researcher performs annotations on the article.

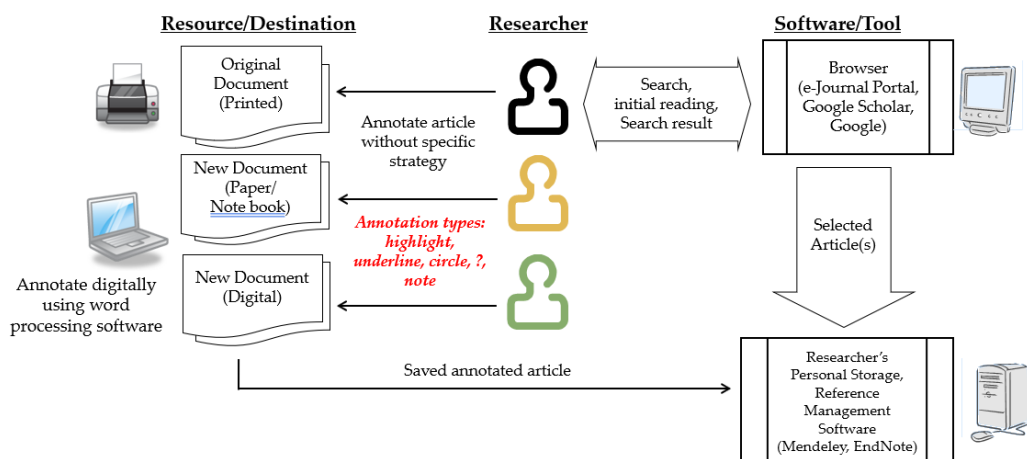


FIGURE 7. Researchers' active reading management scenarios

Researchers do not have a specific strategy for annotating the articles read (Macmullen 2005; Kazai et al. 2008). Identified annotation types used by researchers are underline, highlight, brief note, circle, asterisks, signs such as {, }, [, ], number, (,) and lines (Table 2). The most frequently used annotation type is underlined. The location of the researchers' annotations is mostly on the text in paragraphs, brief notes on the blank spaces between paragraphs, and brief notes on the left, right, top, and bottom margins (Ovsiannikov et al. 1999; Tashman & Edwards 2011). There are also annotations on blank paper and separated digital documents (Marshall & Schilit 1997; Ovsiannikov et al. 1999; Bélanger 2010).

A comparison of functions for Adobe Acrobat 9 Pro, Mendeley Reference Manager, and Microsoft Edge is presented in Table 6. All software provides the function of opening pdf-type files, storing annotations made to the original document, color rendering, adding comments or notes, exposing a list of annotations created on pdf documents, presenting document information, and printing annotations.

**Prototype evaluation** has been conducted by a total of 38 researchers according to suggested annotation strategies and types.

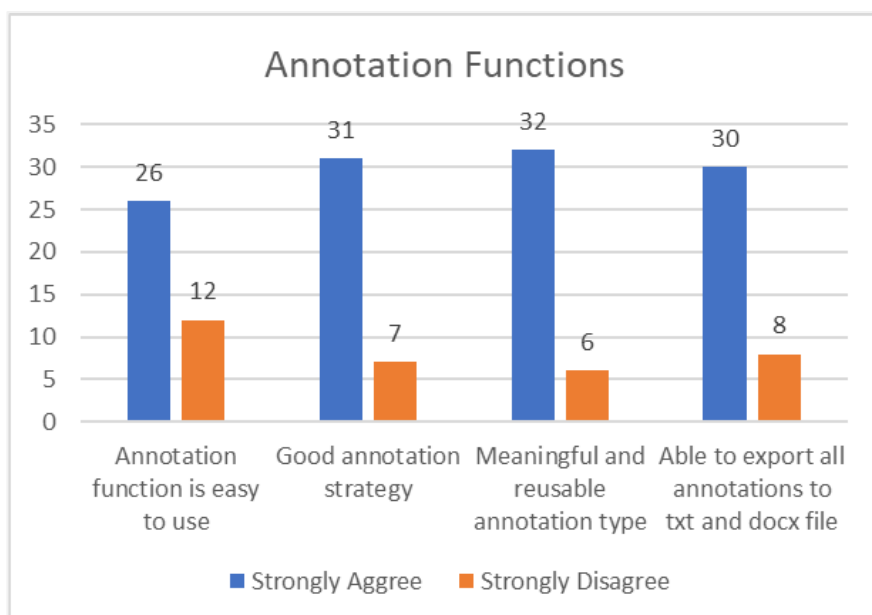


FIGURE 8. Feedback of Prototype Annotation Functions

Figure 8 shows the **feedback** from researchers about the prototype. Twenty-six researchers strongly agree that the annotation function is easy to use, 31 researchers strongly agree that the prototype has a good annotation strategy, 32 researchers strongly agree that the prototype offers a meaningful and reusable annotation type, and 30 researchers strongly agree that the prototype able to export all annotations to txt and docx file.

Table 6 shows the min score results of the prototype functionalities. Open pdf file functioning properly scores 4.2, highlight functioning properly scores 3.8, export functioning properly scores 4.1, export is usable scores 4.3, save functioning properly scores 3.8, and close functioning properly score 3.9. All functionalities level is high based on Ahmad and Tamuri, (2010) scale.

TABLE 6. Mean Score & Levels of Prototype Functionalities

Functionalities	Min Score	Level
Open pdf file functioning properly	4.2	High
Highlight functioning properly	3.8	High
Export functioning properly	4.1	High
Export is usable	4.3	High
Save functioning properly	3.8	High
Close functioning properly	3.9	High

## CONCLUSION

In this paper, we presented the meaning of various styles of annotation strategies. Previous researchers suggested an annotation strategy according to the material or document read. Each annotation strategy has a general or specific type of annotation to give meaning to the reader so that the annotations made are easily understood when referred to by the same individual or another individual.

The prototype provides functions that support the annotation strategies and types when reading scientific articles and better manage the researcher's annotation collection. The implication of

annotation strategy and annotation types of findings indicates that an annotation strategy is good for researchers. Its function is easy to use, meaningful, and reusable. Export functions offer researchers to export their annotations to a txt and docx files.

Overall, researchers are very interested in using prototypes and want to use them to help them read scientifically. Researchers found that they could manage their annotations more regularly, refer to their annotations, and share them with other researchers. Prototype help researchers manage their reading and understanding. Chauhan and Seriani (2019) also suggested readers must learn how to annotate because it is an effective method for developing their confidence as engaged and motivated readers.

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