

Research Trends of Discovery Learning Model in Addressing High School Students' Career Problems: Bibliometric Analysis

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Abstract: This study aims to describe the research trends on the use of the Discovery Learning model in addressing career problems among high school students, with a particular focus on studies published between 2014 and 2024. The study is motivated by the need to develop students' career competencies to help them plan their future and respond effectively to dynamic career challenges. Method: This study employed a bibliometric analysis using international publication data obtained from Google Scholar with the assistance of Harzing's Publish or Perish application. Articles published between 2014 and 2024 were identified using the keywords career and Discovery Learning. The retrieved data were analyzed using VOSviewer to identify keyword co-occurrence patterns, research clusters, and developments in research themes. Results: The analysis identified 19 keywords distributed across five clusters. Research on career-related topics encompasses diverse aspects, including careers, employees, individuals, jobs, and opportunities. Meanwhile, research on Discovery Learning covers several aspects, particularly learning models, learners, and education. These themes have developed over time, with research focusing on addressing students' career problems through independent learning models and exploration of the surrounding environment becoming increasingly prominent in 2021. This trend reflects growing attention to the importance of understanding students' characteristics and potential as a basis for making appropriate career decisions.

Keywords: Discovery Learning; Career; Students

INTRODUCTION

A career is a series of activities related to work, behavior, values, and a person's hopes and goals throughout their life span (Reid et al., 2025). A career can also be defined as a chosen position to pursue and a series of processes that occur according to the stages of human development. The stages of career development are a continuous process in accordance with individual development. According to Super, the stages of human career development consist of five phases, including: the development phase, the exploration phase, the consolidation phase, and the coaching phase. In this phase, high school students are in the age range of 16-20 years, and are in the exploration phase (Lau, 2013). So in this phase, high school students often face problems in the career world.

In reality, many high school graduates experience career challenges related to future planning and are less able to face the challenges of a dynamic future that demands career competency development. Data from the Central Statistics Agency (BPS) in 2023 shows that the highest open unemployment rate (TPT) comes from high school/vocational high school graduates, amounting to 8.41% of the total TPT in February 2023. Furthermore, data from the Central Statistics Agency (BPS) in 2023 also shows that the unemployment rate among high school/vocational high school graduates in Yogyakarta is quite high, at 6,670 people. Furthermore, data from the Yogyakarta Education, Youth, and Sports Agency (Disdikpora) in 2022 states that as many as 20% of high school/vocational high school graduates are still unemployed. This phenomenon indicates that high school/vocational high school graduates have not met the expectations of students, society, and the government.

The phenomenon that occurs in the field is that there are several problems in the career maturity of high school students, including research by Septiani et al., (2021) which revealed that high school education, in addition to emphasizing the theoretical aspects of science, is also expected to be equipped with skills in improving career maturity, but from the study revealed that 50% of students have low career maturity, 30% have good career maturity and 20% have moderate career maturity. Research by Aminah et al., (2021)) The most frequently encountered problems in the career maturity of high school students are grade XII students, including anxiety about the pressure of study choices and lack of knowledge of further studies both themselves and the type of work to be chosen. In line with these problems, research Nurhayati et al.,(2021)) which revealed that high school students are students who are projected to be

able to place ideal positions in their positions and careers, but what was found was confusion and fear in choosing a job. Another problem found is that high school students are not yet able to plan study projects according to their interests. The problem of career maturity of high school students will experience a significant increase when the students are in grade XII and has not been handled well, so more intensive attention is needed.

Based on Super's career maturity theory and the challenges in the field, it is evident that education addressing career maturity issues in high schools has not been optimally implemented (Patton & Lokan, 2001). The role of high schools in addressing career maturity issues is crucial and requires alternative solutions (DURU, 2022). Therefore, alternative solutions to address career maturity issues require in-depth assessments rooted in both students and guidance and counseling teachers. Guidance and counseling teachers must be able to provide psychological support services for students to help them overcome career maturity issues through comprehensive guidance and counseling services.

According to one strategy that can provide students with experience in seeking information and self-reflection so that problems can be identified and students are able to find solutions is discovery learning. The discovery learning model is one model that can develop students' reasoning abilities. Discovery learning is a learning process that emphasizes students' intellectual mentality in solving various problems. faced with challenges, so that they can find concepts or generalizations that can be applied in the field. Discovery learning is also a learning model that focuses on exploring knowledge that students have never known before, and some or all of which is discovered by students themselves.

According to Wilcox et al., (2022)), discovery learning encourages students to learn largely through their own active engagement with concepts and principles, and teachers encourage students to have experiences and conduct experiments that allow them to discover the principles themselves. This understanding can be interpreted as the Discovery Learning Method as a learning model that hones students' abilities in exploring choices or interests, thereby fostering interest in pursuing them. Wang, (2016) Through the observation and implication model, students are able to identify conditions within themselves and their environment. Based on several theories above, it can be concluded that discovery learning is a learning method that focuses on individual skills in identifying and classifying an object with the aim of finding alternative solutions to a problem. In the discovery learning model, students can explore ideas or concepts in drawing conclusions related to the given problem. Before drawing conclusions, students are given the opportunity to collect data so that students can think logically based on facts. In this process, students are given the opportunity to develop reasoning skills in analyzing a problem gradually.

In the Discovery Learning model, students can explore ideas or concepts in drawing conclusions related to a given problem (Ozdem-Yilmaz & Bilican, 2020). Before drawing conclusions, students are given the opportunity to collect data so that students can think logically based on facts. In this process, students are given the opportunity to develop reasoning skills in analyzing problems in the 14 stages in Discovery Learning according to Bruner, namely (1) providing stimulation, (2) problem identification (Problem statement), 3) data collection, 4) data processing, 5) verification, 6) conclusion and generalization. This study was conducted using bibliometric analysis to determine the Discovery Learning model in addressing the career problems of students currently studying in high school. This article will reveal the trends of high school students' career problems that can be addressed with the Discovery Learning model approach and its possible impact on high school students (Khoiriyah & Murni, 2021). In addition, the study looks at efforts that have been made by previous researchers. The analysis conducted in this study is expected to be a reference for the development of further research in the field of guidance and counseling in elementary schools to overcome various existing career problems.

Accordingly, this study employs bibliometric analysis to examine the development and trends of research on Discovery Learning in relation to career issues among high school students. The analysis focuses on publications from 2014 to 2024 and seeks to identify research patterns, keyword clusters, thematic developments, and emerging areas of study. Based on this background, the research problems addressed in this study are: (1) What are the trends in research on Discovery Learning and career from 2014 to 2024? (2) What keywords and thematic clusters characterize research on Discovery Learning and career? (3) How have the themes of Discovery Learning and career developed over the period 2014–2024? and (4) What emerging research themes indicate potential opportunities for applying

Discovery Learning to address career problems among high school students? The findings are expected to provide a research map and reference for future studies, particularly in the field of guidance and counseling, and to support the development of innovative career guidance interventions based on Discovery Learning for addressing high school students' career-development problems.

METHODS

This study uses bibliometric analysis which is a type of quantitative research to examine bibliographic data and is used in many fields. Bibliometric studies are conducted using software as a tool. The research data used in this research process are international publications obtained from Google Scholar with the help of the publish or perish application. The articles used are articles published in 2014-2024 using the keywords "discovery learning", "career" and "student" which are stored in the RIS document. Furthermore, the data was analyzed using VosViewer. The research stages are as follows:

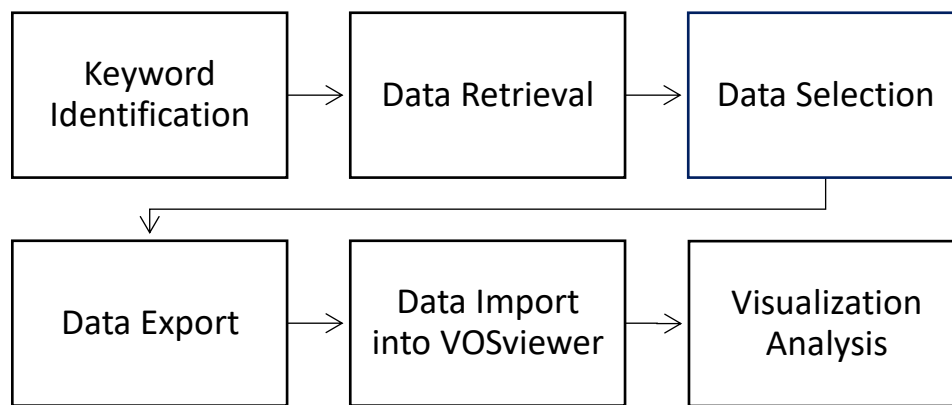


Figure 1. Research Stages

Keyword Identification, The keywords used in this study were "discovery learning," "career," and "student." **Data Retrieval** Bibliographic data were collected from Google Scholar using the Publish or Perish software. **Data Selection,** The retrieved articles were screened based on publication year (2014–2024) and their relevance to the research topic. **Data Export,** The selected bibliographic data were exported in RIS (Research Information Systems) format. **Data Import into VOSviewer,** The RIS file was then imported into VOSviewer for bibliometric mapping and analysis. **Visualization Analysis,** The analysis generated three types of visualizations: **Network Visualization:** illustrates the relationships and co-occurrence among keywords. **Overlay Visualization:** displays research trends over time and highlights emerging topics. **Density Visualization:** shows the concentration and frequency of research themes within the field studied.

RESULTS AND DISCUSSION

RESULT

Based on the results of the bibliometric analysis conducted, it can be seen that the distribution of research topics is related to the research focus of Discovery Learning and career as follows.

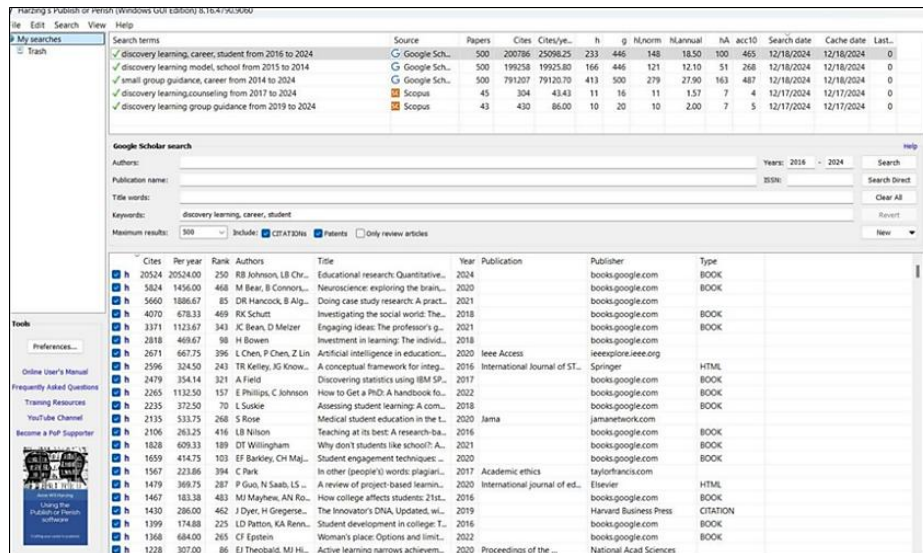


Figure 2. distribution of research topics

Based on a literature search using Publish or Perish on the Google Scholar database with the keywords "discovery learning, career, student" in the period 2016–2024, 500 documents were obtained with a total of 200,786 citations. The analysis results show an h-index value of 446 and an average citation per article of 233. These findings indicate that the study of discovery learning in the context of student career development is a research field that has a high level of academic attention and impact. However, a more specific search using the keywords "discovery learning counseling" and "discovery learning group guidance" in the Scopus database only produced 45 and 43 publications, respectively, thus indicating that there are still open research opportunities related to the integration of discovery learning in career guidance and counseling services.

Based on the results of the bibliometric analysis conducted, it can be seen that the distribution of research topics is related to the focus of the Discovery Learning research. The results of the distribution of research each year can be seen in the following table:

No	Years	citation
1	2014	104
2	2015	68
3	2016	64
4	2017	62
5	2018	56
6	2019	38
7	2020	43
8	2021	27
9	2022	13
10	2023	16
11	2024	9
JUMLAH		500

The data indicate that the highest number of studies discovery learning was published in 2014, accounting for 104 studies (20.8%) of the total publications. This was followed by 2015 with 68 studies (13.6%), 2016 with 64 studies (12.8%), and 2017 with 62 studies (12.4%). The number of publications gradually declined in subsequent years, with 56 studies (11.2%) in 2018 and 38 studies (7.6%) in 2019. A slight increase was observed in 2020, reaching 43 studies (8.6%). However, publication output decreased again in the following years, with 27 studies (5.4%) in 2021, 13 studies (2.6%) in 2022, 16 studies (3.2%) in 2023, and only 9 studies (1.8%) in 2024. Besides that, the bibliometric analysis is as follows:

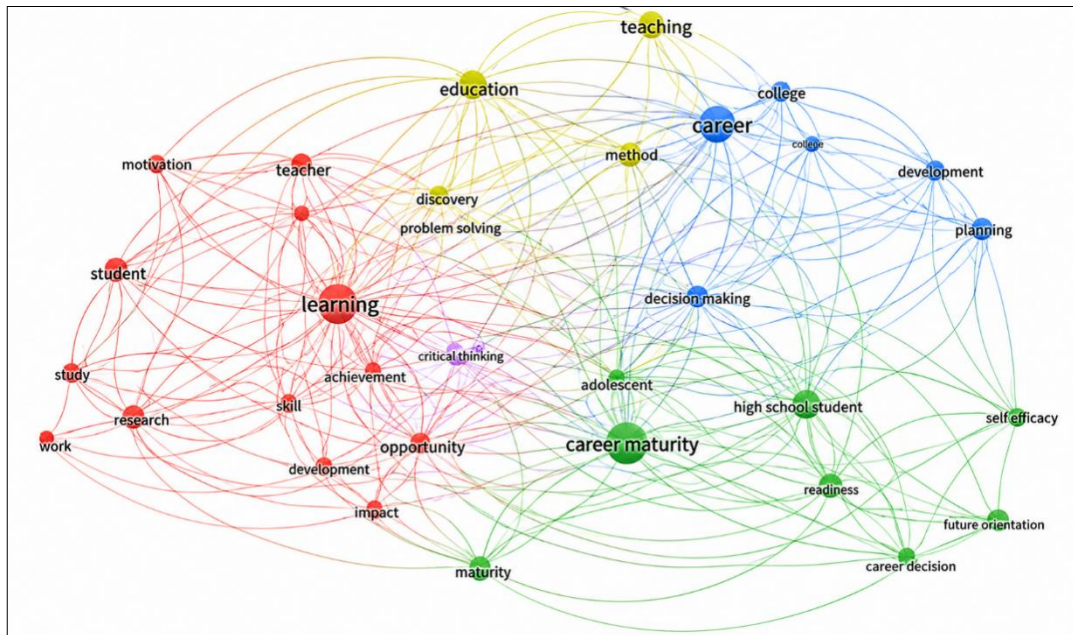


Figure 3. Bibliometric Analysis

Based on the visualization of the keyword network related to cyberbullying, it can be seen that career "is the main and central theme in this study, with discovery learning as one of the media and techniques that can overcome high school students' career problems. The relevant topics that are close to the keywords are opportunity, work, employee and individual. In the VOSview analysis, there are also 5 clusters in the analysis of the latest research trends related to career and discovery learning, namely

- Cluster 1: career, employee, individual, job, opportunity
- Cluster 2: deep learning, model, focus
- Cluster 3: Discovery Learning, education, teacher, learner
- Cluster 4: person, book, way
- Cluster 5: interest, knowledge, time, importance

VOS audience bibliometric network maps the relationships between keywords in research related to "careers and discovery learning". The analysis image is as follows:

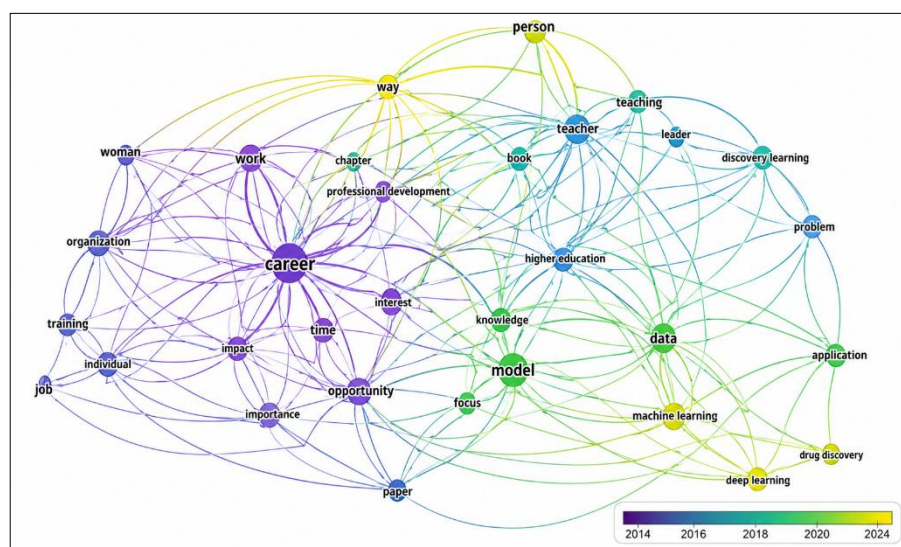


Figure 4. Overlay Visualization of Research Trends in Career and Discovery Learning (2014–2024)

Based on the image above, it can be seen that the VOS viewers bibliometric network maps the relationship between keywords in research related to "career and discovery learning". The visualization above not only shows the relationship between the main keywords and their sub-themes, but also

includes a time spectrum (2014-2024) represented in a color scale, from purple for 2014 to yellow for 2024. In addition, there are several color groups that represent different sub-themes or focuses in the study of career and discovery learning.

1. Purple: includes the keywords career and Discovery Learning which show the relationship between students' career problems that can be solved with the discovery learning approach. Several career maturity problems in high school can be addressed by providing freedom and deep experience for students in determining their future
2. Yellow: includes terms such as data, learning, way. This shows that in preparing an individual's career, comprehensive personal, environmental and social data are needed to be able to show students' career paths that are in accordance with their potential. In addition, the learning process needs to be emphasized on individuals to be able to organize their careers from the smallest things to making career decisions
3. Green: includes the terms, teaching, learner, person, model. The application of discovery learning in overcoming career problems cannot be separated from the role of teachers or educators, this role is emphasized in the learning process, providing models, understanding the characteristics of students as learners. The goal is that when students organize a mature career, a model is needed that is able to provide insight into work, so that students get an idea of the advantages and disadvantages of a job or career

Next, to support the findings, a data visualization of the variables will be presented. In this image, the career variable is displayed in bright yellow and surrounded by several aspects and components, such as interests, occupations, and opportunities. The image is as follows.

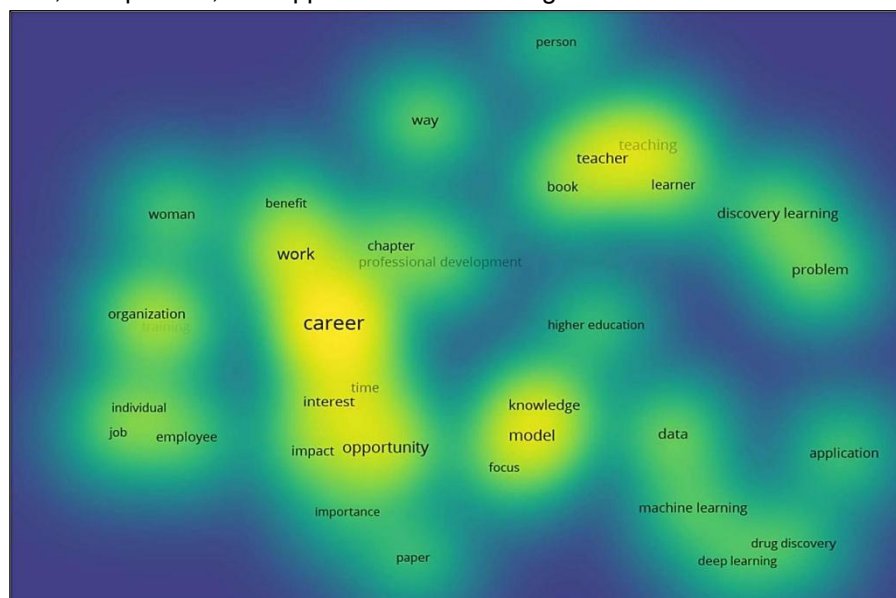


Figure 5. Data visualization of the variables

Figure 5 shows the visualization data of the variables. In the picture, the career variable shows a bright yellow color and is surrounded by several aspects and components, such as interest, work, opportunity. This can be interpreted that an individual's career is determined by interest, job choices and opportunities. In addition, the discovery learning map is close to the teacher, learner and problem (Thao et al., 2020) . This can be interpreted that the solution to career problems is determined by students and teachers. Discovery learning can be one approach used by guidance and counseling teachers in overcoming students' career problems, by relying on independence in finding career reference sources that are in accordance with individual talents and interests.

In addition to the visualization display already explained, here are the results of sorting the data by the highest number of quotes.

Table 2. Most Cited Publications on Career and Discovery Learning Research

citation	Author	Title	Years
1396	W Patton, M McMahon	Career development and systems theory: Connecting theory and practice	2014
1382	EA Ilardi, E Vitaku, JT Njardarson	Data-mining for sulfur and fluorine: An evaluation of pharmaceuticals to reveal opportunities for drug design and discovery: Miniperspective	2014
1368	M Nielsen	Reinventing discovery: the new era of networked science	2020
1304	EB Smith, SM Nkomo	Our separate ways, with a new preface and epilogue: Black and white women and the struggle for professional identity	2021
1287	MB Horn, H Staker	Blended: Using disruptive innovation to improve schools	2014
1236	L Harvey	Beyond member-checking: A dialogic approach to the research interview	2015
1228	PN Blanchard, JW Thacker	Effective training: Systems, strategies, and practices	2023
1217	AB Bakker, S	Work engagement: current trends	2018

Based on table, it can be seen that from the 500 articles that have been obtained, the most citations were owned by Patton in 2014 with the article title Career development and systems theory: Connecting theory and practice. The article was cited 1369 times during the year (2014-2024). From these results, it can be seen that counselors in Indonesia can conduct research development in other directions such as qualitative research that discusses career maturity solutions with a discovery-based approach (independent search).

DISCUSSION

The bibliometric analysis shows that research on Discovery Learning, careers, and students has experienced significant growth during the 2014–2024 period. A search using Publish or Perish in the Google Scholar database yielded 500 documents with a total of 200,786 citations, an h-index of 446, and an average of 233 citations per article. These findings indicate that the topic connecting discovery learning with student career development is a field of study that has received significant academic attention (Deneher, 2000). The high number of citations indicates that research on discovery-based learning and career development has become an important focus in education and human resource development.

The distribution of publications shows that the highest number of research studies was found in 2014, with 104 publications (20.8%), followed by a downward trend until 2024. The decline in publications does not necessarily indicate a decrease in topic relevance, but may indicate a shift in research focus to more specific themes, such as career adaptability, career decision-making, employability skills, self-regulated learning, and digital career counseling. This phenomenon indicates that the concept of discovery learning is no longer studied as a single concept but is beginning to be integrated with various other, more contextual approaches tailored to the needs of 21st-century education (Deneher, 2000). The publication trend reveals an important shift in the research landscape. Although 2014 recorded the highest number of publications, the subsequent decline does not necessarily reflect a diminishing relevance of Discovery Learning. Rather, it may indicate a transition from broad conceptual studies toward more specific and contextualized applications. Research has increasingly addressed themes such as career adaptability, career decision-making, employability skills, self-regulated learning, and digital career counseling. This shift suggests that Discovery Learning is evolving from a general learning model into a flexible approach that can be integrated with contemporary career-development needs. However, the declining number of publications also indicates a potential research gap, particularly in the systematic application of Discovery Learning to high school students' career development and guidance and counseling services. Therefore, future research should move beyond examining Discovery Learning as a general instructional model and focus on developing and empirically testing context-specific, evidence-based interventions for students' career exploration, decision-making, and career planning.

VOSviewer mapping results show that the keyword "career" is a central theme with strong relationships with the keywords employee, job, opportunity, and individual. This finding suggests that student career development is not solely related to job selection but also involves individual readiness to understand opportunities, job characteristics, and the ability to adapt to changes in the world of work.

This finding aligns with Super's career development theory, which explains that individuals in the exploration phase need to develop self-understanding and information about the world of work before making informed career decisions (Savickas, 2024). The VOSviewer mapping indicates that "career" functions as a central concept connecting individual characteristics with the world of work, particularly employees, jobs, and opportunities. This pattern suggests that career development should not be understood merely as the process of selecting an occupation, but as a multidimensional process involving self-understanding, exploration of opportunities, and readiness to respond to changing work environments. Critically, however, the strong connection among these keywords does not by itself demonstrate that students have developed adequate career competencies; rather, it reflects the dominant relationships within the existing research literature. Therefore, the finding highlights a need to strengthen research and career guidance practices that connect self-understanding, knowledge of the world of work, and career decision-making. This interpretation is consistent with career development perspectives emphasizing the importance of developing self-knowledge and understanding occupational environments as foundations for informed career decisions (Savickas, 2024). In this context, Discovery Learning offers potential as an approach for facilitating active career exploration, although its effectiveness for improving students' career development still requires empirical testing.

Cluster analysis yielded five research theme groups. The first cluster, consisting of career, employee, individual, job, and opportunity, shows that most research focuses on individual career development and readiness to enter the workforce. The second cluster, consisting of deep learning, model, and focus, demonstrates the development of research that is beginning to link discovery learning with innovations in modern learning models. The third cluster, consisting of discovery learning, education, teacher, and learner, confirms that discovery learning remains a widely used approach in educational contexts to improve students' thinking and problem-solving skills. The fourth and fifth clusters demonstrate the relationship between personal aspects, knowledge, interests, and time in the career development process. (Ramadhan et al., 2020). Critically, the clustering suggests that career development and Discovery Learning have strong thematic connections, but their integration specifically within school career guidance and counseling remains insufficiently developed. Most existing research appears to examine these themes separately rather than as an integrated intervention for students' career problems. Therefore, the findings point to a research gap and an opportunity to develop Discovery Learning-based career guidance that systematically connects self-understanding, career information, exploration, and decision-making.

Overlay visualization findings indicate that early research focused primarily on basic career concepts and discovery learning. However, in subsequent years, research has expanded to include learner, teaching, model, and knowledge. This development indicates a paradigm shift from an outcome-oriented approach to careers to one that focuses on the learning process and individual competency development. In the context of guidance and counseling, this shift demonstrates the need for students to be given opportunities to actively explore their potential, interests, values, and career opportunities through meaningful learning experiences (Darwin et al., 2020). The density visualization results show that the keyword "career" has the highest density compared to other keywords. This indicates that career issues remain a primary focus of research in education and guidance and counseling. The high density of career themes is understandable given the increasingly complex challenges facing the younger generation in the world of work. Technological developments, changing industry needs, and job market uncertainty require students to develop greater career maturity from the time they are in high school (Shen, 2021).

Another important finding indicates that discovery learning has a strong relationship with the learner, teacher, education, and problem. This indicates that discovery learning is seen as an approach capable of helping students find solutions to various problems they face, including career issues. In discovery learning, students do not simply passively receive information but actively seek out, process, and draw conclusions based on their experiences. This process enables students to develop critical thinking skills, decision-making abilities, and problem-solving skills, which are essential for career planning (Ismail et al., 2018).

The findings have practical implications for school counselors and educational policy. For school counselors, Discovery Learning can be applied as an alternative approach to career guidance by

encouraging students to actively explore their interests, abilities, educational opportunities, and occupational alternatives. Counselors can facilitate students through problem identification, information gathering, analysis, verification, and career planning. This approach supports more active and independent career exploration. For educational policy, the findings support the development of student-centered career guidance programs that emphasize career exploration, problem-solving, decision-making, and career planning. The limited research specifically connecting Discovery Learning with career counseling also provides an opportunity for further development and evaluation of evidence-based interventions in school guidance and counseling.

CONCLUSION

Career is a sequence of activities related to work, behavior, values, and expectations and goals of a person during the life span of that person. The stages of human career development consist of five phases, including: development phase, exploration phase, consolidation phase, coaching phase and decline phase. In this phase, high school students are in the age range of 16-20 years, and are in the exploration phase. So in this phase high school students often encounter problems in the world of career. In reality, many high school graduates experience career problems concerning future planning and students are less able to face the challenges of a dynamic future that demands the development of career competencies from these students. The existence of high schools in overcoming career maturity problems is important and requires alternative solutions to problems. So alternative solutions in solving career maturity problems do require in-depth assessments that are rooted in students and guidance and counseling teachers through the learning process. Discovery learning encourages students to learn mostly through their own active involvement with concepts and principles and teachers encourage students to have experiences and conduct experiments that allow them to discover principles for themselves. This understanding can be interpreted to mean that the Discovery Learning method is a learning model that hones students' abilities in exploring choices or interests, thereby fostering an interest in pursuing these things.

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