Research in Engineering Education Symposium-2024
Jan 4-6, 2024 - Hubballi, India

Svadhyaya: A Story Telling Model for Discovery Oriented Learning

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Abstract

Context

Developing problem solving skills has been an emphasis from schooling to degree programs and beyond. Problem based learning and discovery oriented learning share several common philosophies of learning. One can be integrated into another for an effective classroom delivery. On other hand, NEP 2020 aims to bring and develop the essential problem solving skills rooting from our arts and literature.

Purpose or Goal

Considering the importance of problem based learning, discovery oriented learning and storytelling, this work proposes the following research questions: How can we integrate the story telling experience from arts and literature into the discovery oriented learning model integrated with problem based learning? How can a case study help to build an inventory of use-cases that can be connected to computer science concepts and principles?

Methods

With a pragmatic philosophical assumption, qualitative research method was adapted where in two cycles of coding: structural, vivo and focused coding were used for data analysis. Data was collected using case study approach. Self-selection was used for sampling and a total of 26 participants were part of the study in three iterations excluding the researcher. Case study templates were designed and improved with iterations starting from the seven jump problem based learning model.

Outcomes

Themes were generated for each of the iteration and the template of problem analysis was improved over the process. A structural phase-wise associative template was developed for the storytelling model. A deductive tree was designed to generate inventory of use cases as a further closure addressing the two formulated research questions.

Conclusion

Objectives, culture and deductions being identified as the three major elements of the case study, further evolved to a template that can assist in storytelling case study design. Storytelling promises to be one of the means to support the discovery oriented learning.

Keywords—discovery oriented learning; problem based learning; story telling; svadhyaya

I. INTRODUCTION

ONE of the essential life skills that an individual must hone to excel in professional life is the problem solving capability. From schooling to a degree program, and also beyond, problem solving skill is emphasized via various aspects. Several models have been designed and deliberated to enhance the problem solving skills. The ability to solve problems is articulated as one of the most important manifestations of human thinking (Holyoak, 1990). The theories of problem solving have been discussed giving prominence to the problem space and providing a framework for understanding the process of solving them (Newell & Simon, 1972). Though the problem solving process can be evaluated (Charles, 1987), the context and methodology usually varies from the domain and the result required.

The experiences of problem solving can help one learn the content and also develop the thinking strategies (Hmelo-Silver, 2004). There is copious literature to prove the effectiveness of problem based learning in numerous learning environments. From problem space analysis to writing objectives and building a project, the approach has been realized in various formats and synergies. The goal four of the United Nations sustainable goals talks about 'quality education' (Biermann et al., 2017). In the regards, the Union Cabinet of India rolled out India's new education system policy through National Education Policy, approved on 29th July 2020.

The National Education Policy 2020 document accentuates the below mentioned opinions (Govinda, 2020):

- The need for a pedagogy that makes education more experiential, holistic, discovery-oriented, flexible and enjoyable.
- The curriculum must be also based on arts, literature, culture, values, etc.
- The course delivery must emphasize conceptual understanding.
- The pedagogy must have story-telling and art-integration.
- The new skilled professionals must have holistic development with respect to humanities, art, social science, problem solving etc.

https://doi.org/10.52202/073963-0028

There can always be alternatives and varied schools of thought to realize the culture and art-form based models in the education system. However, the end learning objective remains the same: pedagogy to enhance the learning via story telling. Through life experiences and events though one develops basic problem solving capability, modern complex problems need more than routine thinking. Understanding the basic principles from the classics can strengthen ones comprehension skills and can serve as major criteria for applied skill enhancement.

Discovery oriented learning emphasizes learning experiences as against the memorization. It attempts to provide meaningful experiences (Castronova, 2002) in the process of learning. The research part of finding out solutions to the problem allows students to analyze information and integrate the concepts for an improved educational experience. Problem solving, active engagement, critical thinking, self-directed learning, inquiry and exploration and application of knowledge are some of the common characteristics between problem based learning (De Graaf and Kolmos, 2003) and discovery oriented learning. It has also been compared with other learning strategies (Savery, 2006). Using discovery oriented learning for problems in problem based learning can help in initial exploration, promote self-directed inquiry, help to address open ended questions and provide a space for reflection and synthesis (Efedni et al., 2020). Hence this work integrates both of them to design a story-telling model.

The paper is further divided into following sections: Section 2 presents the literature survey. Section 3 presents the research design and methodology. Section 4 presents the data analysis and findings. Section 5 initiates the discussion with conclusion in section 6.

II. Literature Survey

This section presents the literature survey majorly on Problem Based Learning (PBL), Discovery-Oriented Learning (DOL) and storytelling. DOL emphasizes open-ended exploration. It is often initiated by the student's curiosity. DOL study often beings with no pre-defined problem to solve. Though there are several common characteristics, both of them also differ on numerous aspects. DOL can be an effective tool to realize PBL. This section hence reviews both the domains.

PBL finds its roots from the medical domain (Barrows, 1986), giving a thick literature of its usage (Barrows and Tamblyn, 1980), and today being used by all other domains. It has also been integrated with other learning styles and frameworks, for example its experimentation in a constructivist learning environment (Savery and Duffy, 1995). If not used for entire curriculum, PBL has been integrated in the classrooms on need basis (Stepien and Gallagher, 1993) as well used by administrators since ages (Bridges, 1992).

PBL is effective on several fronts and usually works well for smaller classrooms (Schmidt, 2011). Though there is no one common definition of PBL, it has common characteristics like critical thinking, self-directed learning, collaboration etc. When the learning is experience based, students learn through the thinking strategies (Hmelo-Silver, 2004). A meta-analysis on the method states that the process is proven to be effective in the learning process (Dochy et al., 2003).

The benefits of PBL have been psychologically analyzed (Norman and Schmidt, 1992). The method has been employed from schools (Achilles and Hoover, 1996) to start-ups (San and Ng, 2006) and the traditional methods have been critiqued in comparison (Mills and Treagust, 2003). PBL helps in knowledge construction process (Colliver, 2000). Merits and demerits of the process have been analyzed (Schmidt et. all., 2011).

In DOL students vigorously explore topics, concepts, or phenomena independently or via guided inquiry (Hammer, 1997). It encourages self-directed learning, critical thinking, and practical exploration, allowing deeper understanding of concepts by letting learners make detections and connections through their own efforts and inquisitiveness. It's a student-centered method (Wolfe, 1992). The theoretical foundations of the method have been discussed (Svinicki, 1998). The method also encourages creative thinking (Rahman, 2017). The model's effectiveness has been studied with respect to critical and cognitive thinking (Martaida et al., 2017). Innovative studies like using moon for DOL have been carried out (Cummins et al., 1992). From mathematics to English, it has been used in several domains as a teaching-learning strategy. We can however comprehend that PBL and DOL are based on the common theories of active learning, inquiry and exploration, critical thinking, collaborative learning. DOL can be integrated with PBL as a mode to solve the problems. DOL and PBL models have been compared and deliberated for similarities and differences and the study concluded that in terms of high-level thinking ability both the models provide the same effectiveness (Setyaningrum et al., 2020).

Story telling in education research has been explored on theoretical basis with story as method (Gallagher, 2011). It has been used as a pedagogical tool in higher education (Abrahamson, 1998). With the advent of technology, story-telling has gone digital and has been integrated in education pedagogies (Alismail, 2015).

The literature survey provides a scope to combine all the methods and develop a model to use it as pedagogy in the classroom teaching and learning. The model can also enable a student to construct a knowledge base which can further assist as per the NEP 2020 guidelines. Using the culture and folklore can also spike the interest in students on how the classic theories and stories are relevant in the contemporary world. With the common characteristics, storytelling and DOL can be integrated with PBL as a delivery model for the problem scenarios.

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III. METHODOLOGY

This section presents the research design that was followed for the proposed work. Philosophical assumptions, research question, model, context, data collection process, sampling methods and case study selection process are discussed.

A. Philosophical Assumptions

Pragmatic philosophical assumptions (Creswell & Poth, 2013) are made for this work as it allows the researcher to follow dynamic and innovative ways to explore the research problem at hand (Morgan, 2014). It allows a researcher to take operational decisions in the best interest of research study domain (James, 1975). In the context of research study, observes its inherently defined limitations and biases that could be reflected in the study participants and researchers describing the axiological beliefs. The reality for this work, being multiple, was constructed based the research participants and from the researcher perspective. The knowledge construction has happened with researcher being an insider and by comprehending subjective evidences from the research participants. Every participant constructed their own reality with their experiences constituting the ontology. The methodology followed is qualitative approach.

B. Research Question

Keeping the motivation of the study in mind, in consideration to PBL and DOL, two research questions were formulated as listed below:

RQ1: How can we integrate the story telling experience from arts and literature into the discovery oriented learning model integrated with problem based learning?

RQ2: How can a case study help to build an inventory of use-cases that can be connected to computer science concepts and principles?

C. Context

The context of the study was students who had completed their second year of engineering from KLE Technological University from School of Computer Science and Engineering. The study was carried out over two years with two iterations and two batches.

D. Initial Model Elements

The initial model design work was carried out by using the seven jump model (Murwantini, 2015) which was applied on painting Guernica painted by Pablo Picasso. The painting features imagery and symbolism depicting the horrors of the war, particularly the bombing of the Spanish town of Guernica during the Spanish Civil War (Ray, 2006). The reason to select this case study is because of its color scheme, the figures used, the emotional space and the conflicts it gives rise to (Patterson, 2007). Seven jump is one of the prominent PBL models used by several universities and domains (Harimurti, 2023). The different steps of seven jump model was listed out and analysed with the identified case study. As a researcher, then the steps were used on the painting Guernica to arrive at the initial model elements of Svadhyaya. The term Svadhyaya means self-study derived from the language Sanskrit. The components of the model developed can be seen in Figure 1.

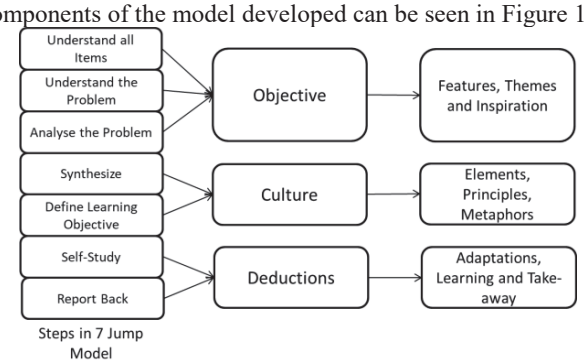

Fig 1. Components of Svadhyaya

The major components identified for the model were Objectives, Culture and Deductions. The mapping of the different phases of the seven jump model is presented in the figure. Each element is defined by three listed properties as shown in the Figure 1. As an example, Culture was identified by the three features namely: elements that constituted it, principles that defined it and metaphors related to it. The features were identified by the detailed qualitative analysis on the developed case study by using structured and in-vivo coding.

E. Data Collection Process and Sampling

Students were provided with case study and templates for the completion and submission with 3 day time. Students were free to use any available resources for the study. No specific training was provided to complete the case studies. Student submitted sheets were used for analysis. Cases studies were employed are they can be used to connect and understand complex issues of real-life context (Cousin, 2005). Case studies can be used for critical thinking and reflections on the real-life scenarios (Merriam, 1988). Cases from arts and literature were selected as they naturally assimilate into the storytelling (Meretoja & Davis, 2017) and provide a power for narration (Lothe, 2017). Reflections on the arts and storytelling have been discussed in the literature (Johnson, 2016).

As per the university guidelines a consent form was shared detailing the research question and process to all the participants. Only upon the agreement, students were handed over the task. The participation was optional. Self-selection was used for the data collection (Sharma, 2017). A call-for was made for the students to participate in the research during summer holidays. Everyone who agreed was provided with a case study and a template to complete. Snowballing process was further used to enroll if anyone else from their contact would be interested in the process (Goodman, 1961). In snowball sampling participants assist in identifying the potential participants for the study.

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F. Participant Details

The initial design was made by the researcher in the first iteration. For second and third iterations, research participants were students who had completed their second year. The numbers are presented in Table 1. The total process took over in three iterations of refinement.

TABLE I
PARTICIPANTS

SI. No.	Iteration	Number of Participants
1	01	01
2	02	07
3	03	19

G. Objectives

The objectives of the work are as listed below in Table 2. The objectives were designed based on the research questions and they were further used to design the case study using pieces from arts and literature. The objectives were used to break down the research questions into smaller achievable tasks.

TABLE II
OBJECTIVES

ID.	Objective
OB1	To identify the works from arts and literature for the case study design
OB2	To comprehend the parameters of storytelling via a template design and iteratively improve it.
OB3	To realize the story telling elements into the engineering course delivery using the metaphors and inventory of use-cases

H. Case Study Selection

In the first round the case study selected was the painting Guernica as it has ample metaphors connected to it (Picasso et al., 1956). The painting has also been adapted into several other forms. The painting is basically a story of war and its sufferings. It was a suitable case study to apply the seven steps on. In the second round, as there were seven students, seven new case studies were selected. The selection was made from the possible entire genre list that could be thought of. Books, movies and variety of domains were covered based on popularity and its social awareness from the arts and literature. The selection was guided by the first version of template designed. Cases were selected that had objectives, culture and deductions. The seven selected case studies are presented in Table 3. Every student was assigned with one case study. In the second round, three more studies were included as there were more students and each student was asked to submit two case study solutions. The additional list of three is presented in Table 4.

TABLE III
CASE STUDY LIST 1

No.	Case Study
1	The destruction of Tripura
2	Horcrux from Happy Potter
3	Infinity Stones from Avengers
4	The Seven Ravens
5	The Game of Dice from Mahabaratha
6	The Lord of the Flies
7	Schindler's List

TABLE IV
CASE STUDY LIST 2

No.	Interview Question
1	The Old Man and the Sea
2	Rigveda
3	Aboriginal Australians

IV. DATA ANALYSIS AND FINDINGS

For case study completion, students were provided with a table template to fill the data. The template provided is presented in Table 5 below. This template was designed by the researcher with the model as described in the Figure 1.

TABLE V
CASE STUDY TEMPLATE 1

Criteria	Description
Case Study Metadata	
Name	Name here
Case Study	Cast study name
Prominence	What is the prominence of the case study?
Synopsis	Write a short synopsis
Model Analysis	
Phase 1: Objective	
Theme	What theme do you see in this art?
Inspiration	Does it have an inspiration?
Features	What are the prominent features?
Phase 2: Culture	
Elements	What are the major elements of the art?
Metaphors	Does it stand as a metaphor for something?
Principles	What principles does it observe?
Phase 3: Deductions	
Adaptations	Has there been an adaptation of it?
Learning and Take-away	What did you learn from this? Can you write its applications?

On the case study data, two rounds of coding were carried out. In the first round a mixture of structured and in-vivo coding was used. In structured coding, we code the passages according to the research question or topics (Lampert & Ervin-Tripp, 1993). In In-vivo coding we use the exact phrases and words that are collected from description and perspectives

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https://doi.org/10.52202/073963-0028

(Manning, 2017). Focused coding was employed for the second round where we categorize the related and merge the information at need (Stuckey, 2015).

A next level template was generated for iteration 3 students based on the data analysis carried out from iteration 2. The template is presented in Table 6.

TABLE VI
CASE STUDY TEMPLATE 2

Criteria	Description
Case Study Metadata	
Name	Your Name Here
Case Study	Cast study name
Prominence	What is the prominence of the case study?
Synopsis	Write a short synopsis
Model Analysis	
Phase 1: Init	
Theme	What theme do you see in this case study? What does it represent?
Inspiration	Does it have an inspiration?
Features	What are the prominent features?
Objective	What objectives do you observe?
Phase 2: Operational	
Culture	Does it bring out any cultural elements?
Elements	What are the major elements of the case study?
Metaphors	Does it stand as a metaphor for something? Do you connect to some other work of similar kind? Does it have an abstraction?
Principles	What principles does it observe?
Phase 3: Deductions	
Adaptations	Has there been an adaptation of it? Movie? Song? Why?
Analysis	What is your analysis? Did it amaze you?
Inventory of Use-Cases	Write the applications and context you observe. Where can this case study be used? Can we use it to teach something?

Some of the coding samples are described along with how the themes were generated. A student had written inspiration as 'Good and evil, war and peace' for destruction of Tripura. These clearly indicated the THEME of the story. The dice game unfolded later to a war. The theme here was PROBABILITY GAME. With such code generations, a new element THEME was generated with a description of 'what does this represent'.

Students had listed out all the characteristics and parts that constitute a case study. In Seven Ravens, a complete list of characters, sun, moon, grief, death, baptism etc. were listed out. Hence a new theme of ELEMENTS was coded. USE CASES theme was generated in a similar way so to extend a case study to other domains and list its applications.

Horcrux was to protect the one who created it. Tripura wanted to bring order in the universe. Such statements represented the OBJECTIVE of the work and hence a theme was designed for the same. Students had listed out varied thoughts of objectives of each work and they were all relevant. This led to the generation of next level template.

The second template being the learning from the first one was clear with its objectives. Students were given a clear set of indicators on how to work on the case study and what to discover further. They were asked to build upon an inventory of case studies in the end for the case study they were exploring. Trigger points were provided for each element in order to gain a new perspective from the case study. The Table 7 below lists some of the use cases listed by students.

TABLE VII
USE CASES SAMPLES

SI. No.	Case Study	Use Case
1	Infinity Stones	The six stones are six ingredients of preparation
2	Horcrux	Once when something is on internet, we don't know how many forms it has taken. It may never be deleted and copy might always exist.
3	Game of Dice	Marketing strategies
4	Destruction of Tripura	The strength of doing together, time loop, radicalism of group
5	The Old man and The Sea	When process is more important that results

The case studies have contributed in the learning process and to discover new perceptions about the world we live in. On asking if we could use these case studies as learning materials, 18 students said 'yes'. The numbers are in Table 8. 'Not sure' could also mean a polite no. However, it could also mean they need more clarity on where and how to use it.

TABLE VIII
CASE STUDY USAGE

Attribute	Number of Agreement
Yes	18
No	0
Not sure	8

V. DISCUSSION

Considering the first research question, our analysis indicates that Table 6, case study template 2 is the means by which we can integrate the story telling experience from arts and literature into the discovery oriented learning model integrated with problem based learning. A faculty or a center that generates case studies, has to select a work from arts and literature, apply and analyze with the template and with the uses cases and metaphors generated, can decided to use it on the allied principles and concepts. The table can also help to deduce the cultural elements from the study.

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Story telling is an art. The different adaptations of each case study indicate that the same story can take different forms based on the domain. This also means that they can be used to understand principles of foundational courses in engineering (Refer Table 7). Resources optimization is the major theme for operating system course. Process management is what software engineering all about. The different elements constitute in the schema design of the database. These were the points that came from the student inventory use-case samples. This answers the research question number two (Refer Figure 3).

A detailed analysis of these case students has led to a path that they can be connected to the engineering concepts. The strategies could also motivate students to come up with new algorithms design techniques which is the current need of the hour in data science. Most important of all, it makes students curious and excited. Students were asked how much time they spent on the case study and the numbers can be seen in the Figure 2 below.

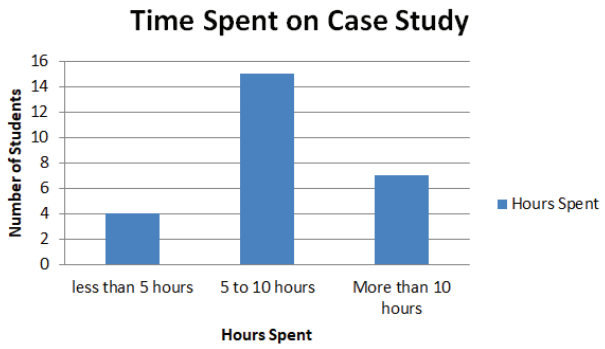

Fig 2. Time spent on case study

Majority (15) of the students spent 5 to 10 hours on each case study. 7 students expressed that they spent more than 10 hours.

A deductive tree can be seen in Figure 3 below.

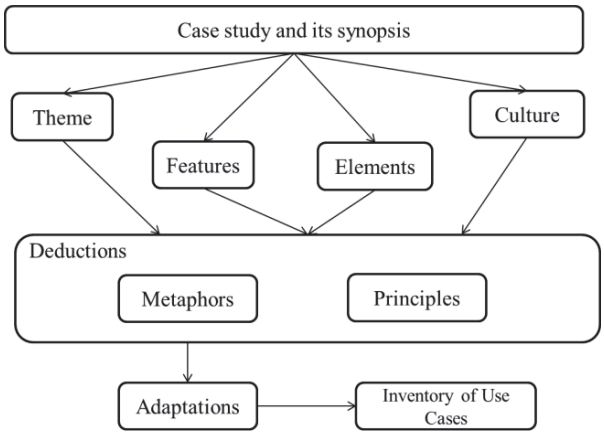

Fig. 3: Case study deductive tree

The tree represents, drawn from the Table 6 elements, as we believe, on how the knowledge of a student grows with respect to the case study. This hierarchy can lead to discovery of use-cases that they can connect with the course concepts. Before arriving at metaphors and principles, they need to identify the four mentioned components on the synopsis. This tree can be used as a template for the storytelling and discovery oriented learning. The tree emerged during the second level coding in iteration 3. The themes, features, elements and culture in the case study help in arriving at deductions. From the deduction, we can classify the metaphors and principles. The different adaptation of the study can be analyzed using these and they lead to the inventory of use cases that can be used as the computer science study materials.

Following are the other significant conclusive discussion points that we can arrive at from the case study research. Each case study had several metaphors to unravel (Barcelona, 2001). The model helped students to get a bigger picture of a classic tale. A lot of our ancient stories have symbolism (Feldman, 1990). They are not just stories, but they capture the social orders and dynamics of a society and they can be used in the case study and storytelling (Goodwin, 1982).

The analysis part connected to the course concepts that students have studied in the past. The examples can be used to connect to the concepts from all the domains. As most of the research is influenced by the sociology, the arts and literature can be used to convey not only the morale but can also stand as a foundational concepts of theories (Landrum et al., 2019). The deductions can help one to build a frame work with respect to individual domain of consideration. The principles can be used to give larger and basic meanings of life principles, to arrive at, and their applications.

VI. Conclusion

Arts and literature are also the means of dissemination of morale and life principles into the social order. An artistic tells a story with his work. Since the ancient times they have been a medium to preserve and forward the cultural and demographic characteristics. Svadhyaya model attempts to bring them systematically into the classroom case studies. Svadhyaya model encompasses the critical elements: objectives, culture and deductions for a case study. The model promises to be one way of bringing arts and literature into the classrooms via storytelling. NEP 2020 aims to build a knowledge base to use such works from arts and literature into the class room delivery. With the template designed, Svadhyaya keeps the first step towards such a knowledge base.

The discussion section also provides a scope to design future research questions, design instruments and validate the metaphors, principles, adaptations and inventory use-cases, effectively and probably with discovery-oriented learning.

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https://doi.org/10.52202/073963-0028

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REFERENCES

Achilles, C. M., & Hoover, S. P. (1996). Exploring Problem-Based Learning (PBL) in Grades 6-12.

Abrahamson, C. E. (1998). Storytelling as a pedagogical tool in higher education. Education, 118(3), 440-452.

Alismail, H. A. (2015). Integrate digital storytelling in education. Journal of Education and Practice, 6(9), 126-129.

Barrows, H. S., & Tamblyn, R. M. (1980). Problem-based learning: An approach to medical education. Springer Publishing Company.

Barrows, H. S. (1986). A taxonomy of problem-based learning methods. Medical education, 20(6), 481-486.

Barcelona, A. (2001). On the systematic contrastive analysis of conceptual metaphors: Case studies and proposed methodology. Applied cognitive linguistics II: Language pedagogy, 117-146.

Biermann, F., Kanie, N., & Kim, R. E. (2017). Global governance by goal-setting: the novel approach of the UN Sustainable Development Goals. Current Opinion in Environmental Sustainability, 26, 26-31.

Bridges, E. M. (1992). Problem Based Learning for Administrators. ERIC Clearinghouse on Educational Management, University of Oregon, 1787 Agate Street, Eugene, OR 97403-5207.

Castronova, J. A. (2002). Discovery learning for the 21st century: What is it and how does it compare to traditional learning in effectiveness in the 21st century. Action research exchange, 1(1), 1-12.

Charles, R. (1987). How To Evaluate Progress in Problem Solving. National Council of Teachers of Mathematics, 1906 Association Drive, Reston, VA 22901.

Colliver, J. A. (2000). Effectiveness of problem-based learning curricula: research and theory. Academic medicine, 75(3), 259-266.

Cousin, G. (2005). Case study research. Journal of geography in higher education, 29(3), 421-427.

Creswell, J. W., & Poth, C. N. (2013). Philosophical assumptions and interpretive frameworks. Qualitative inquiry and research design: choosing among five approaches. Los Angeles: Sage Publications, 15-41.

Cummins, R. H., Ritger, S. D., & Myers, C. A. (1992). Using the Moon as a tool for discovery-oriented learning. Journal of Geological Education, 40(2), 142-146.

Dochy, F., Segers, M., Van den Bossche, P., & Gijbels, D. (2003). Effects of problem-based learning: A meta-analysis. Learning and instruction, 13(5), 533-568.

De Graaf, E., & Kolmos, A. (2003). Characteristics of problem-based learning. International Journal of Engineering Education, 19(5), 657-662.

Efendi, F., Fitria, Y., Farida, F., & Hadiyanto, H. (2020). Perbedaan Model Problem Based Learning dengan Discovery Learning terhadap Higher Order Thingking Skills dan Self Directed Learning di Sekolah Dasar. Jurnal Basicedu, 5(1), 301-309.

Feldman, S. P. (1990). Stories as cultural creativity: On the relation between symbolism and politics in organizational change. Human relations, 43(9), 809-828.

Gallagher, K. M. (2011). In search of a theoretical basis for storytelling in education research: Story as method. International Journal of Research & Method in Education, 34(1), 49-61.

Govinda, R. (2020). NEP 2020: A critical examination.

Goodman, L. A. (1961). Snowball sampling. The annals of mathematical statistics, 148-170.

Goodwin, M. H. (1982). "Instigating": Storytelling as social process. American ethnologist, 9(4), 799-816.

Hammer, D. (1997). Discovery learning and discovery teaching. Cognition and instruction, 15(4), 485-529.

Harimurti, S. M. (2023). Seven Jump PBL to Connect Modern Problems to Sciences. Asia Pacific Journal of Management and Education (APJME), 6(1), 1-15.

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn?. Educational psychology review, 16(3), 235-266.

Holyoak, K. J. (1990). Problem solving. Thinking: An invitation to cognitive science, 3, 117-146.

James, W. (1975). Pragmatism (Vol. 1). Harvard University Press.

Johnson, C. (2016). The Way of the Writer: Reflections on the Art and Craft of Storytelling. Simon and Schuster.

Lampert, M. D., & Ervin-Tripp, S. M. (1993). Structured coding for the study of language and social interaction. Talking data: Transcription and coding in discourse research, 169-206.

Landrum, R. E., Brakke, K., & McCarthy, M. A. (2019). The pedagogical power of storytelling. Scholarship of Teaching and Learning in Psychology, 5(3), 247.

Lothe, J. (2017). Storytelling and Ethics: Literature, Visual Arts and the Power of Narrative.

Martaida, T., Bukit, N., & Ginting, E. M. (2017). The effect of discovery learning model on student's critical thinking and cognitive ability in junior high school. IOSR Journal of Research & Method in Education, 7(6), 1-8.

Manning, K. (2017). Organizational theory in higher education. Routledge.

Meretoja, H., & Davis, C. (Eds.). (2017). Storytelling and ethics: Literature, visual arts and the power of narrative. Routledge.

Morgan, D. L. (2014). Pragmatism as a paradigm for social research. Qualitative inquiry, 20(8), 1045-1053.

Mills, J. E., & Treagust, D. F. (2003). Engineering education—Is problem-based or project-based learning the answer. Australasian journal of engineering education, 3(2), 2-16.

Merriam, S. B. (1988). Case study research in education: A qualitative approach. Jossey-Bass.

Murwantini, S. (2015). Application of Seven Jump Method with Approach to Problem Based Learning on Students in Program Studi of Mechanical Engineering Education Fkip Palangkaraya University Academic Year 2014/2015. BALANGA: Jurnal Pendidikan Teknologi dan Kejuruan, 3(1), 29-37.

Newell, A., & Simon, H. A. (1972). Human problem solving (Vol. 104, No. 9). Englewood Cliffs, NJ: Prentice-hall.

Norman, G. T., & Schmidt, H. G. (1992). The psychological basis of problem-based learning: A review of the evidence. Academic medicine, 67(9), 557-565.

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Patterson, I. (2007). Guernica and total war (Vol. 4). Harvard University Press.

Picasso, P., Larrea, J., & Barr, A. H. (1956). Guernica. Hammarby Tryckeri.

Ray, B. (2006). Analyzing political art to get at historical fact: Guernica and the Spanish civil war. The Social Studies, 97(4), 168-171.

Rahman, M. H. (2017). Using discovery learning to encourage creative thinking. International Journal of Social Sciences & Educational Studies, 4(2), 98.

Savery, J. R. (2006). Overview of problem-based learning: definition and distinctions, the interdisciplinary. In Journal of Problem-based learning.

San Tan, S., & Ng, C. F. (2006). A problem-based learning approach to entrepreneurship education. Education+ Training, 48(6), 416-428.

Schmidt, H. G., Rotgans, J. I., & Yew, E. H. (2011). The process of problem-based learning: what works and why. Medical education, 45(8), 792-806.

Setyaningrum, W., Riani, A. L., & Wardani, D. K. (2020). Comparison of Problem-Based Learning and Discovery Learning Model. International Journal of Multicultural and Multireligious Understanding, 7(3), 305-313.

Sharma, G. (2017). Pros and cons of different sampling techniques. International journal of applied research, 3(7), 749-752.

Stepien, W., & Gallagher, S. (1993). Problem-based learning: As authentic as it gets. Educational leadership, 50, 25-25.

Stuckey, H. L. (2015). The second step in data analysis: Coding qualitative research data. Journal of Social Health and Diabetes, 3(01), 007-010.

Svinicki, M. D. (1998). A theoretical foundation for discovery learning. Advances in physiology education, 275(6), S4.

Wood, D. F. (2003). ABC of learning and teaching in medicine: Problem based learning. BMJ. 326 (7384): 328–330.

Wolfe, C. R. (1992). Using an authoring system to facilitate student-centered discovery oriented learning. Computers & Education, 19(4), 335-340.

https://doi.org/10.52202/073963-0028