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Harnessing The Theory of Discovery to Enhance Project-Based Learning of Pupils in Primary Schools

Benebo-Solomon, Wilhelmina (PhD)
Department of Early Childhood/Primary Education, Faculty of Education, Ignatius Ajuru University of Education, Port Harcourt, Rivers State, Nigeria

Ebolume, Florence Chinwe
School of Early Childhood Care and Primary Education, Federal College of Education, Gombe, Gombe State, Nigeria

Abstract: *The primary school pupil is a child that is yearning for learning and exploration of the environment. Due to children's curiosity and inquisitiveness at this level, there are needs to use appropriate learning methods that can actually lead children to explore their environment. Despite the fact that pupils are supposed to enjoy the learning process, there seem to be a breach in pupils' interest. This loss of interest has manifested in pupils making noise during lesson, withdrawal from participating in classroom discussion. This paper therefore proposed that, if project-based learning is used as a method of teaching in primary school, the principles of doing as prescribed by theory of discovery will be harnessed and pupils will learn better. In the course of the discussion, this paper outlined practical ways of using project-based learning to harness the theory of discovery which include; use of open-ended questions that provoke inquiry and curiosity, creating resource-rich environment for children to explore, and connecting projects to real-life context among others. The paper further implied that, classroom activities should include tasks involving tangible materials or tools to encourage exploration and sensory engagement among children. It was however suggested in this paper that, to harness the theory of discovery and enhance project-based learning, caregivers should be equipped with skills to design open-ended enquiry-driven projects, that allow children explore, hypothesize and experiment through training programmes; initiate projects that are relevant to pupils' experiences, interest and local environment among others.*

Key words: *Discovery, Project-Based Learning.*

Introduction

In the contemporary educational landscape, fostering meaningful learning experiences that resonate with pupils' curiosity and real-world understanding has become a top priority. One compelling strategy that aligns with this goal is the integration of the theory of discovery into project-based learning (PBL). Rooted in the constructivist framework, the theory of discovery championed by Jerome Bruner emphasizes active engagement, exploration, and the learner's construction of knowledge through inquiry and problem-solving. Bruner (1966) argued that when learners are encouraged to discover concepts and relationships for themselves, they develop deeper understanding, improved retention, and greater independence in thought.

Project-based learning, on the other hand, is an instructional method that organizes learning around complex tasks, framed in the form of projects that typically span several days or weeks. It encourages

collaboration, critical thinking, and hands-on engagement with content. The synergy between discovery learning and PBL is powerful: both emphasize learner autonomy, real-world relevance, and inquiry-based tasks. When the theory of discovery is harnessed effectively within PBL, pupils are not only participants in learning activities but also become investigators, problem-solvers, and creators of knowledge.

This paper seeks to explore how the principles of the discovery learning theory can be strategically applied to enhance the effectiveness of project-based learning among pupils. It highlights the theoretical underpinnings, practical applications, and potential benefits of this integrative approach, aiming to provide educators with insight into fostering deeper cognitive engagement, motivation, and skill development in young learners. Through this exploration, the paper underscores the need to shift from traditional didactic methods to more learner-centered approaches that support the holistic development of pupils in 21st-century classrooms.

The classroom has been a place or situation where pupils interact with curriculum content and materials for learning to take place. It is a given space for pupils to explore their environment and attain developmental heights that are necessary. As a stimulating platform, the classroom offers pupils the ability to ask questions, explore certain ideas, principles and innovation which could foster profitable learning by them.

Pupils under the auspices of the teacher are taught using certain principles and theories as guidelines. The approaches used in the classroom as those prescribed by theorists or philosophers. One of the approaches used in teaching preschoolers is project-based learning. The theory of Discovery therefore, seems to have a lot to do with the use of project as a basis for teaching in primary schools. To discuss how pupils can harness the theory of Discovery through project-based learning in primary schools, this paper will dwell on the following:

- Concept of project-based learning
- An overview of the theory of Discovery
- Practical ways of harnessing the theory of discovery through project-based learning in primary schools
- Implications of project-based learning on children's development

Concept of Project-Based Learning

Project-based learning in primary schools is a pupil-centered teaching method in which pupils learn through actively engaging in practical, meaningful projects. This is because these preschoolers are not in an imaginary world but a real world. This approach fosters discovery and problem-solving skills, as pupils work on extended projects that involve inquiry, research, collaboration, and the application of knowledge. By situating learning in authentic, hands-on contexts, project-based learning promotes engagement, critical thinking, and personal investment in the learning process (Capraro et. al., 2017). Project-based learning involves:

- **Authentic problems and questions:** A central feature of project-based learning is that, it engages pupils in investigating real-world issues or complex questions. For example, a project could involve studying the impact of recycling at school and devising a plan to improve it. These authentic problems prompt pupils to conduct research, gather data, and develop solutions. Through this means, learning becomes more relevant and connected to pupils' everyday lives (Krajcik & Shin, 2016).
- **Pupil-driven inquiry and research:** Project-based learning emphasizes preschoolers' autonomy by encouraging pupils to ask questions, conduct investigations, and find answers independently or in groups. The teacher's role is that of a facilitator who guides the inquiry process rather than providing direct answers. This inquiry-based structure helps pupils develop important skills, such as formulating questions, researching, analyzing information, and synthesizing findings (Blumenfeld et. al., 2017).

- **Collaboration and communication:** In project-based learning, pupils often work in teams to solve problems, which promote collaboration and interpersonal skills. Through group work, they learn to communicate ideas, listen to others, resolve conflicts, and share responsibilities. Such social skills are integral to 21st-century education and prepare pupils for collaborative work environments. Working together on projects also foster a sense of community and shared purpose (Thomas, 2017).
- **Creation of Tangible Products or Presentations:** Project-Based Learning projects typically culminate in a tangible product, presentation, or performance that demonstrates pupils' learning. For example, a project on local history might result in a digital presentation or a physical exhibit. Creating a final product requires synthesis of what they have learned, reinforcing retention and understanding. This process also encourages pupils to take pride in their work and boosts motivation (English & King, 2019).
- **Reflection and assessment:** Reflection is a crucial aspect of project-based learning, allowing pupils to think critically about what they have learned, how they approached their projects, and what they might do differently in the future. Teachers also assess pupils' progress throughout the project to provide constructive feedback, emphasizing both the process and the final product. This ongoing reflection and assessment make project-based learning an iterative, growth-oriented learning approach (Darling-Hammond et al., 2017).

The involvement of pupils in Project-based learning in the classroom brings about a lot of benefits to both the pupils and the teachers. Project-based learning connects learning to real-world situations, making education more engaging and relevant to pupils. The hands-on nature of project-based learning often increases motivation as pupils become interested in solving problems that matter to them, which can lead to deeper learning (Boaler et al., 2016). By working through complex problems, pupils develop essential critical thinking skills. They learn to analyze situations, weigh evidence, make decisions, and solve problems independently. Project-based learning fosters an inquiry-based mindset that encourages pupils to become curious, lifelong learners (Schwarz et al., 2016). It equips pupils with key skills that extend beyond the classroom, including collaboration, communication, and adaptability. Through projects, pupils learn to work both independently and as part of a team, preparing them for future academic and professional experiences (Pellegrino et al., 2020).

Research suggests that, project-based learning enhances knowledge retention, as pupils actively apply what they learn in practical contexts. The hands-on, problem-solving nature of project-based learning helps solidify understanding and makes concepts memorable (Barron & Darling-Hammond, 2018). Despite the several learning benefits of project-based learning, implementing it effectively in primary schools requires careful planning and support. Teachers need adequate training to facilitate inquiry-based learning effectively, and resources such as time and materials must be available to support project work. Additionally, pupils may require scaffolding to ensure they stay on track, as younger students may initially struggle with self-directed learning. To maximize the use of project-based learning in the classroom, it is proper to consider the ideas and principles of the theory of discovery by Jerome Brunner.

Project-based activities are very serious constituents of present-day learning situations that allow pupils to actively engage in meaningful learning experiences by exploring real-world problems and creating tangible solutions to the observed problems. These activities have a lot benefits on pupils, as they foster critical thinking, collaboration, communication, creativity, and problem-solving skills (Thomas, 2020). In schools, especially public primary schools, various project-based activities are strategically designed to align with curriculum objectives while promoting hands-on and inquiry-based learning. The following are some of the project-based activities carried out by pupils in schools:

Science experimentation: One prominent project-based activity commonly carried out by pupils in school is science experimentation. Pupils often engage in designing and conducting simple experiments in the sciences, related to topics such as plant growth, magnetism, or states of matter. These projects allow pupils to form intelligent assumptions about the outcome of events, gather data, and draw conclusions, thereby cultivating scientific thinking and curiosity.

Another key activity is environmental projects, where pupils participate in school gardening, recycling initiatives, or campaigns against pollution. This is where pupils plant flowers in condemned vessels, pots as vases, using used water to water plants, using old newspapers for artistic designs among other things. Through these projects, they learn about sustainability, environmental stewardship, and their role in preserving natural resources (Chen & Yang, 2022). For instance, designing a school compost system or creating posters to raise awareness about climate change are practical ways pupils apply environmental science concepts.

Art and design projects are also widely practiced. Pupils are encouraged to express themselves creatively by designing posters, creating collages, or constructing models from recyclable materials. These activities not only enhance fine motor skills and aesthetic awareness but also promote cultural appreciation and personal expression (Nguyen & Wargo, 2021).

Technology and engineering projects are gaining popularity, especially in STEM-focused schools. Pupils may engage in building simple machines, coding basic software applications, or designing bridges using everyday materials. These types of projects help develop computational thinking and an understanding of engineering principles (Barron & Darling-Hammond, 2021).

In the area of social studies, pupils undertake community-based projects such as researching local history, mapping their neighborhoods, or interviewing elders about traditions and cultures in order to gain and preserve cultural knowledge which is the foundation of their cultural heritage. As posited by Krajcik and Shin (2020), projects of this nature build civic responsibility and deepen pupils' understanding of their social environments. Literacy-based projects are also common, such as writing and illustrating storybooks, conducting book reviews, or staging role-plays and dramatizations of texts. These activities promote reading comprehension, vocabulary development, and oral communication (Beers & Probst, 2022). Pupils become active participants in their literacy journey, often sharing their final products with peers or community audiences.

Furthermore, entrepreneurial projects have become integral in some schools, where pupils create and market handmade products or organize mini-businesses as part of economic education. Through this exposure, pupils do simple baking, bead making among other entrepreneurial skills. Such projects nurture business acumen, financial literacy, and leadership skills (Chikwere et al., 2023). Upon mastering of these skills, pupils become independent financially at adulthood due to the exposure to project-based learning. Overall, project-based activities in schools are multifaceted and interdisciplinary, aimed at fostering holistic development and lifelong learning. They provide an authentic context for pupils to apply their knowledge and skills in meaningful ways, promoting deeper understanding and active engagement in their education.

An Overview of the Theory of Discovery by Jerome Bruner (1966)

The theory of discovery was propounded by Jerome Bruner in 1966. This theory that bordered on cognitive development of children which is enforced through discovery has three stages of Enactive, Iconic, and Symbolic representation. Bruner posited that learners interpret the world differently at each stage, and these differences have direct implications on how learning should be structured. The three stages of discovery include:

1. Enactive Stage (0-1 Years): Learning through Action

In the Enactive stage, learners represent and understand the world through physical action and direct manipulation. Knowledge is encoded through motor responses rather than symbolic representation, meaning that understanding is dependent on action. For example, a child might learn about objects by physically interacting with them, developing an understanding of shape, size, and movement through manipulation.

2. Iconic Stage (1-6 Years): Learning through Images and Visual Representation

In the Iconic stage, learners start to use visual representations, such as pictures and mental images, to understand concepts. This stage allows children to interpret ideas without needing to perform the action physically. Mental imagery and visual patterns become integral as learners begin to form

cognitive associations with images rather than actions alone. This stage covers period of early childhood education, where learners are given deliberate attention towards improving their developmental milestones.

3. Symbolic Stage (7 Years and Older): Learning through Symbols and Abstract Thoughts

The Symbolic stage is marked by the ability to think abstractly, using symbols, language, and codes to understand concepts. At this stage, learners can interpret the world symbolically, such as through words, numbers, and formulas, allowing for complex reasoning and problem-solving.

Strategies for Harnessing Theory of the Discovery to Enhance Project-Based Learning in Primary Schools

Project-based learning (PBL) allows primary school pupils to engage in discovery-based learning, where they explore topics through hands-on activities and problem-solving, fostering critical thinking and deeper understanding. Below are practical ways that pupils can harness the theory of discovery through PBL in primary schools:

- Science exploration projects: Science-based PBL projects, such as building simple ecosystems or experimenting with plant growth, allow pupils to engage in the scientific process and discover principles at firsthand. For instance, pupils can plant seeds in different conditions, document growth, and analyze how variables like light and water affect results, thereby learning through self-guided discovery (Schwarz et al., 2016). This hands-on approach develops critical thinking as pupils formulate hypotheses, conduct experiments, and observe outcomes.
- Environmental conservation initiatives: Projects that focus on environmental stewardship, like recycling drives or composting, help pupils discover the impact of their actions on the environment. By analyzing waste, creating compost bins, and designing posters on sustainable practices, pupils actively learn about environmental science. Barron and Darling-Hammond (2018) found that projects that incorporate community and environmental themes encourage discovery learning, as pupils connect classroom knowledge to real-world issues.
- Cultural heritage and community mapping: Exploring community history through a mapping project enables pupils to discover their local heritage while developing social studies skills. They can create maps, interview community members, and document local landmarks. This helps them relate geography and history to the environment where they live, fostering a deeper understanding of place and community (Capraro et al., 2017). Such projects promote active learning and curiosity, essential elements of discovery learning.
- Engineering and design challenges: Design-based PBL projects like constructing model bridges or vehicles introduce pupils to engineering principles and problem-solving. For example, a challenge to build a bridge using limited materials encourages experimentation with different designs and materials, where pupils discover structural concepts such as stability and balance (English & King, 2019). This approach teaches engineering fundamentals through exploration and iterative learning.
- Mathematics in real-world contexts: By embedding mathematics in projects, like creating a class store where pupils manage "money," pupils discover math concepts in real-world scenarios. Handling currency, calculating prices, and making change builds numeracy skills, helping them connect mathematical theory with practical applications. A study by Boaler et al. (2016) found that applying math in meaningful, project-based contexts enhances students' problem-solving and critical thinking skills.
- Cultural exchange and social studies projects: Projects on cultural diversity, such as researching and presenting on different countries, enable pupils to learn through inquiry and discovery. They can explore aspects like traditional clothing, language, and cuisine. Such activities not only build research skills but also promote empathy and global awareness by helping pupils discover the importance of cultural diversity.

- Health and nutrition projects: Pupils can work on projects like creating a "healthy lunch menu" or planning a school garden to discover principles of nutrition and biology. Engaging in discussions on food groups and designing menus gives pupils an understanding of healthy eating and nutrition's role in well-being (Krajcik & Shin, 2016). Through this exploration, pupils connect theoretical health concepts to practical applications, reinforcing understanding through discovery.
- Stories and literacy projects: Creating storybooks, comic strips, or multimedia presentations encourages discovery in literacy. By composing stories, pupils learn about narrative structure, vocabulary, and self-expression, actively discovering language power (Pellegrino et al., 2020). Storytelling projects allow them to experiment with language in a meaningful context, fostering creativity and language skills.

These practical applications of PBL empower pupils to harness discovery-based learning, deepening engagement and retention of knowledge by actively connecting concepts to real-world applications. This hands-on, inquiry-driven learning cultivates critical thinking, problem-solving, and a love for learning, laying a strong foundation for academic and personal growth.

Practical Application of the Theory of Discovery by Classroom Teachers in Primary Schools

The theory of discovery learning, embedded in the works of Jerome Bruner, emphasizes that pupils can actively participate, explore, and construct their own knowledge through direct engagement with materials and problems. Most recently, teachers have found this theory very effective when applied to project-based learning; where they assist pupils to undertake meaningful projects that solve real-world problems or explore authentic challenges, with the quest of getting solutions. Teachers play a critical role in applying the discovery approach to maximize the benefits of project-based learning, particularly in primary school settings. Teachers can actually help in the harnessing of this theory in promoting project-based learning by pupils in the following ways:

Posing open-ended questions that provoke inquiry and curiosity

One practical way teachers can apply the theory of discovery in project-based learning is by posing open-ended questions that provoke inquiry and curiosity. Rather than presenting facts, teachers can initiate learning with real-world problems or very serious questions pertaining to how to reduce waste or issues regarding environmental sustainability. These kinds of questions invite exploration and stimulate pupils' natural curiosity (Savery, 2021). By framing lessons around such questions, teachers in a way encouraged pupils to investigate, hypothesize, and test their ideas, in line with Bruner's discovery learning model.

Creating a resource-rich environment

Creating a resource-rich environment is essential. Teachers should be able to provide different learning tools such as digital media, charts, models, manipulatives, and access to outdoor or community spaces. These resources allow pupils to experiment, manipulate, and observe, thus facilitating hands-on learning and problem-solving. Well-structured discovery environments support children's intrinsic motivation and deepen their understanding of concepts.

Scaffolding the learning process

Scaffolding the learning process is another effective strategy. While discovery learning emphasizes pupil-led exploration, younger learners still need guidance to stay focused and to avoid cognitive overload. Teachers could break down tasks into smaller, manageable components, guide pupils through research techniques; which are broken down into consumable bits, and support them in recording observations or analyzing findings. For instance, during a project on plant growth, a teacher might provide observation charts, direct pupils to measure and record plant height weekly, and assist them in drawing conclusions from their data.

Facilitating collaborative group work

Facilitating collaborative group work supports discovery and enriches project-based learning. Teachers can organize pupils into teams where they share ideas, divide roles, and co-construct knowledge. Collaboration not only fosters social skills but allows learners to encounter diverse

perspectives and refine their thinking through peer discussion. As revealed by Jalongo (2022), this social interaction during discovery activities improves cognitive flexibility and boosts creative problem-solving.

Connecting projects to real-life contexts

Connecting projects to real-life contexts enhance relevance and motivation. Teachers are supposed to engage pupils on practical lessons or topics that have bearing with real life situations. Discovery becomes meaningful when pupils see how their learning applies outside the classroom. For instance, a project on recycling that involved making a school-wide awareness campaign or building items from reused materials, give learners a sense of purpose and accomplishment. Such connections foster deeper engagement and lead to lasting assimilation (Barron & Darling-Hammond, 2021).

Implications of project-based learning on children's Development

The theory of discovery has influence classroom teaching approach, due to the new quest for hands-on learning for children in primary schools. It is expected therefore, that, the following should be done by educational stakeholders to improve the learning, knowledge and skills acquisition of pupils as they engage in project-based learning in the classroom:

- Classroom activities should include tasks involving tangible materials or tools to encourage exploration and sensory engagement.
- Discovery learning should now incorporate visual aids and diagrams to stimulate understanding
- As pupils proceed to other levels of development, the teachers and parents should involve problem-solving activities, hypothetical reasoning, and symbolic tasks (e.g., math problems or scientific experiments) that challenge learners to apply what they are doing to real world situation.

Conclusion

The classroom has gotten a paradigm shift from the conventional ways of doing things to a more child-centred practical approach. These new approaches give room for child-assisted instruction, exploration and independence. Through project-based learning, pupils can actually harness the tenets, ideas and principles inherent in the theory of discovery in their daily learning and development. It is therefore certain from the various literature reviewed in this paper, that project-based learning could be used to harness the ideas and contribution of discovery theory in the classroom; giving the classroom learning situation a shift in a good direction.

Way Forward

The following have been suggested to help harness discovery and enhance project-based learning by pupils in primary schools:

- Equip caregivers with skills to design open-ended, inquiry-driven projects that allow pupils to explore, hypothesize, and experiment through training programs.
- Develop projects that are relevant to pupils' experiences, interests, and local environments.
- Use guiding questions and real-life problems to spark curiosity and initiate discovery.
- Create learning spaces that allow hands-on experimentation, access to diverse materials, and technology for exploration.
- Support pupils' learning by offering appropriate guidance, cues, and feedback during projects without giving away direct answers.
- Gradually reduce support as pupils gain confidence and competence in discovering information on their own.
- Integrate real-life problems and involve community experts or field trips to deepen pupils' understanding and relevance of projects.
- The school curriculum should be aligned with discovery-based project learning by including interdisciplinary themes and flexible content.

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