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IMPLEMENTATION GUIDE CENTRALIZED LEARNING ON STUDENTS

DIRECTORATE GENERAL OF HIGHER EDUCATION, RESEARCH AND TECHNOLOGY,
MINISTRY OF EDUCATION, CULTURE, RESEARCH AND TECHNOLOGY
2023

STUDENT-CENTRED LEARNING

IMPLEMENTATION GUIDE

DIRECTORATE OF LEARNING AND STUDENT AFFAIRS DIRECTORATE GENERAL OF HIGHER EDUCATION MINISTRY OF EDUCATION AND CULTURE

STUDENT-CENTRED LEARNING IMPLEMENTATION GUIDE

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IMPLEMENTATION GUIDE
STUDENT-CENTRED LEARNING

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SYNOPSIS

DIRECTOR GENERAL OF HIGHER EDUCATION, RESEARCH AND TECHNOLOGY

The National Higher Education Standards (SN-Dikti), as stipulated in Permendikbud Number 3 of 2020 article 14 paragraphs (2) and (3), states that the learning process through curricular activities must use effective learning methods in accordance with the characteristics of the course to achieve certain abilities set out in the course in a series of fulfilment of Graduate Learning Outcomes (LLOs). The learning methods referred to, which can be selected for the implementation of learning in the course, include: group discussions, simulations, case studies, collaborative learning, cooperative learning, project-based learning, problem-based learning, or other learning methods that can effectively facilitate the fulfilment of Graduate Learning Outcomes (LLOs).

Some learning methods as mentioned in article 14 of SN-Dikti, are actually to facilitate *student-centred learning* (SCL). The application of student-centred learning is intended so that the Graduate Learning Outcomes (SLOs) are achieved through a learning process that prioritises the development of creativity, capacity, personality, student needs, and develops independence in seeking and finding knowledge. The development of abilities that are in accordance with the needs of these students is expected to produce graduates who are ready to win the increasingly complex challenges of life in the 21st century. For this reason, on this occasion I urge all universities to develop and implement student-centred learning in accordance with SN-Dikti.

I would like to express my gratitude to the team that has worked hard with dedication, as well as to all those who have provided valuable input, so as to further enrich knowledge and insight into the development and implementation of student-centred learning. Finally, I hope that this guidebook is useful for universities and can be used as a reference in developing effective learning processes in higher education in order to produce civilised, knowledgeable, professional, and competitive Indonesians in the era of the industrial revolution 4.0, and contribute to the welfare of the nation's life.

Jakarta, February 2023

Acting. Director General of Higher Education, Research and Technology

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FOREWORD

DIRECTOR OF LEARNING AND STUDENT AFFAIRS

The National Higher Education Standards (SN-Dikti) state that a study programme is a unit of education and learning activities that has a specific curriculum and learning methods in one type of academic education, professional education, and/or vocational education. This means that, in addition to developing the curriculum, study programmes have the obligation to develop appropriate learning methods, which are able to facilitate student-centred learning as mandated by SN-Dikti.

We all understand that there is no one best or most suitable method to implement student-centred learning. The suitability of learning depends on, among others, learning outcomes, characteristics of teaching materials, student characteristics, availability of resources, and learning environment. In addition, the implementation of learning also depends on the assessment of learning. There is a tendency for students to only learn about what will be assessed or tested, as a result, assessment will become their orientation in learning. So instead of the curriculum being the guideline, it is the assessment that becomes the focus of orientation, so that the learning is implemented less attention. This is less of a problem, if the assessment is in line with the curriculum, or if the assessment is aligned with the learning outcomes that have been formulated.

Based on this problem, the Directorate of Learning and Student Affairs, Directorate General of Higher Education, Research and Technology, Ministry of Education and Culture, publishes the Student-Centred Learning Implementation Guidebook so that it can be used by universities, especially study programs, as a guideline in implementing learning that is in accordance with SN-Dikti, and in line with the Main Performance Indicators (IKU) of Higher Education, especially IKU 7 related to collaborative and participatory classes. Criticism and suggestions from all readers are very much expected for the improvement of this guidebook. On this occasion I would like to express my gratitude and appreciation to all members of the writing team as well as to all those who have contributed suggestions and thoughts full of dedication to the realisation of the publication of this book. Hopefully this guidebook will be useful for all of us in order to implement student-centred learning in in accordance with SN-Dikti.

Jakarta, February 2023

Acting. Director of Learning and Student Affairs

Sri Gunani Partiwi

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A Learning Challenges in the Industrial Age 4.0

Industry 4.0 has brought unprecedented changes to social life. The digital revolution of the previous era has not only impacted the transfer of technology in the industrial world but also in broader areas of life with exponential speed of change. This rapid and unpredictable change comes as billions of people are connected. The third industrial revolution was fuelled by the use of computers which became the transition to telecommunications technology, production automation, and rapid services (Fomunyam, 2019). People use digital technology and the internet in all aspects of life.

Higher education has been quicker to adapt and utilise these changes for both learning and research. According to George Courous, "technology will never replace great teachers, but technology in the hands of great teachers is transformational" (Dabbagh, Marra, & Howland, 2018). The benefits of technology in education relate to expanding accessibility, collaboration, communication, value diversity, active and social learning, self-direction, content engagement, project learning and global exposure. Emerging problems in life as individuals and in society have encouraged interdisciplinary learning approaches such as integrating science, technology, engineering, arts and maths (STEAM).

The twenty-first century is characterised by the need for higher education. The wider access to education is followed by a very diverse profile of new students with their abilities and backgrounds. This diversity carries over to the learning environment on campus (Gosper & Ifenthaler, 2014).

The shift in the way learning resources are fulfilled has also shifted from print media to electronic media which can be obtained through easier and faster access to information with the internet. The diversity of learning resources that are easily accessible still requires guidance and assistance so that the scientific information sought is correct and according to the learning objectives.

The availability of communication devices such as *smartphones* and tablets has made a new communication model between lecturers and students, between lecturers, between students, and also other support staff. The interaction between lecturers and students can take place anytime anywhere which allows students to not have to continue to be on campus, but can determine a place of learning that is fun and makes it easier for them to learn and gain real experience needed in life after completing their education.

The freedom of access in content development and presentation platforms challenges lecturers from their traditional roles as curators and knowledge providers. Kittur and Kraut (2008) stated that the *wisdom of crowds*, characterised by the emergence of pages with many authors and volunteers such as Wikipedia, has proven to be able to replace the existence of printed information media such as Encyclopedia. Access to that information becomes a new business opportunity with the existence of *Big Data* that can reach information about user habits, browsing, and tracing history, interests, pleasures, and friendship networks (Cavoukian, 2000).

Based on the above description, the concept of lifelong learning has become real. Lecturers are required to continuously update their knowledge to be in line with students' learning needs. The forms and methods of learning chosen must also be able to provide opportunities for students to gain their own knowledge from various learning sources and meaningful learning experiences.

B Learning Paradigm Shift

In the industrial era 4.0, the world of education has not escaped the impact of the changes that come with it. The way students learn, the way lecturers teach, and the way learning is managed have also changed. Learning is required to be more open, more flexible, and not allergic to the use of technology. Likewise, the challenges faced by the world of higher education have changed from domestic, to regional and now international challenges. The globalisation of education is inevitable.

The world of higher education today has truly entered the era of education 4.0. The era of education 4.0 (*Education* 4.0) requires lecturers and education managers to provide choices for students who

more than ever before, and more *personalised learning* options according to students' interests and talents. Education that focuses not only on the achievement of student learning competencies, but also the formation of noble character and ethics. Education that does not only focus on mastering knowledge in accordance with its field, but is also required to be able to develop multidisciplinary, interdisciplinary, and transdisciplinary science and technology. This is very much in accordance with Law No.12 article 4 of 2012 concerning higher education, namely: 1) developing abilities and shaping the character and civilisation of a dignified nation in order to educate the nation's life; 2) developing innovative, responsive, creative, skilled, competitive, and cooperative academicians through the implementation of tridharma; and 3) developing science and technology by paying attention to and applying humanities values.

One of the prominent features in the Education 4.0 era is the massive use of information technology in the learning process, so that students have access to richer learning resources, and can learn anytime and anywhere. Learning becomes a lot of choices, and the learning experience will help students not only to achieve learning competence but will also increase their learning capacity. This approach is often called the heutagogy approach, as shown in Figure 1.

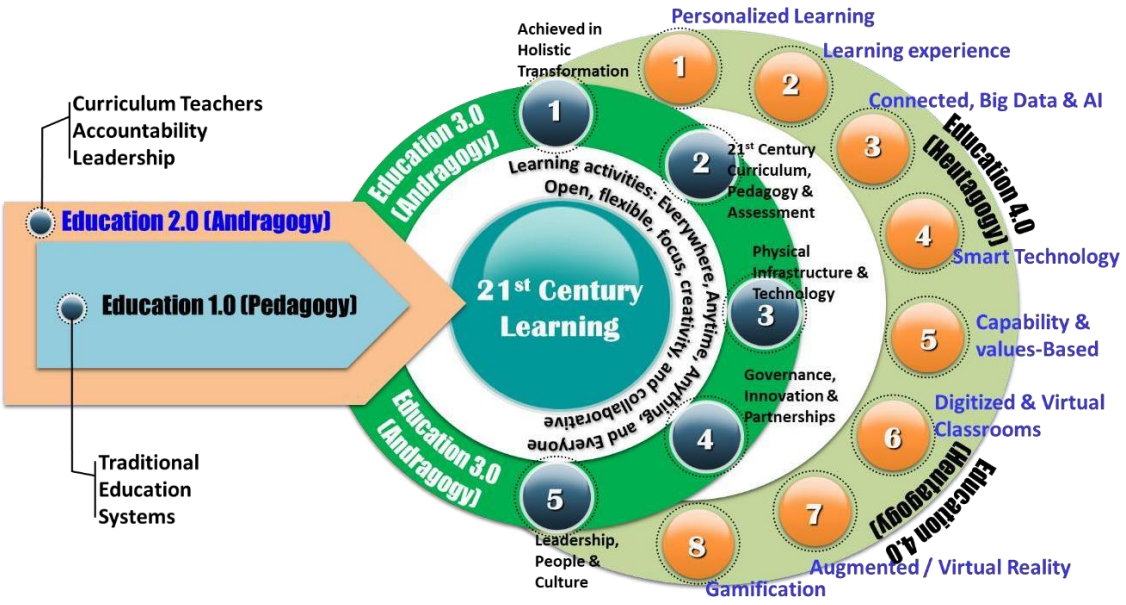


Figure 1: Education paradigm shift

Universities must be able to organise innovative learning that supports the development of the potential of each student efficiently and effectively. The role of lecturers as the driving force in learning must be able to develop a student-centred learning system. Lecturers are able to innovatively choose forms and methods of learning that encourage students to have the ability to communicate, work in teams, collaboratively, think critically, act creatively, have logical and argumentative thinking skills, have concern for environmental sustainability, and respect differences with noble national values.

The correct selection of learning activities and learning methods combined with the harmonious use of technology in learning is the key to its success. Methods that can be chosen include case-based learning, problem-based learning and inquiry, collaborative learning, co-operative learning, project-based learning in collaborative teams. Of course, the use of technology such as: *eLearning*, *mLearning*, *smart classroom*, *augmented and virtual reality*, and gamified material presentation will be very helpful. Therefore, lecturers need to be encouraged and facilitated to have the knowledge and skills to develop and implement these learning methods combined with the use of Information and Communication Technology (ICT).

C Definitions Used in the Guide

The following definitions are used in this guidebook.

1) **The curriculum** is a set of plans and arrangements regarding the objectives, content, and learning materials as well as the methods used as guidelines for organising learning activities to achieve Higher Education goals (Permendikbud, 2020).
2) **Higher Education** is the level of education after secondary education which includes diploma programmes, bachelor programmes, master programmes, doctoral programmes, and professional programmes, as well as specialist programmes, organised by universities based on the culture of the Indonesian people.
3) **The Higher Education Curriculum** is developed by each Higher Education Institution with reference to the National Higher Education Standards for each Programme Study which includes the development of intelligence.

intellectual, noble character, and skills Law No. 12 of 2012 on Higher Education: article 35 paragraph 2 (Law, 2012).

4) **The Higher Education Curriculum** for **undergraduate programmes** and **diploma programmes** according to Law No. 12 of 2012: article 35 paragraph 3 must contain courses (Law, 2012):
   a) Religion;
   b) Pancasila;
   c) Citizenship; and
   d) Bahasa Indonesia.

5) **Learning** is the process of student interaction with lecturers and learning resources in a learning environment.

6) **Study Programme** is a unit of education and learning activities that has a certain curriculum and learning methods in one type of academic education, professional education, and/or vocational education.

7) **Graduate Profile** is a characteristic or role that can be performed by graduates in certain fields of expertise or work fields after completing their studies.

8) ***The Programme Educational Objective*** **(PEO)** is a general statement that describes what graduates are expected to achieve within a few years of ***graduation***. PEOs are based on needs and predictions of future capabilities.

9) **Learning Outcomes** are abilities obtained through the internalisation of knowledge, attitudes, skills, competencies, and accumulated work experience (Presidential Regulation No. 8, 2012).

10) **Graduate Competency Standards (SKL)** are minimum criteria regarding the qualifications of graduates' abilities which include attitudes, knowledge, and skills which are stated in the formulation of Graduate Learning Outcomes (ELOs) Permendikbud No. 3 of 2020: article 5 (1) (Permendikbud,
    2020).

11) *Subject matters* contain knowledge from a particular discipline or knowledge that students learn and can demonstrate (Anderson & Krathwohl, 2001).

12) **Learning materials** are knowledge (facts, concepts, principles, theories, and definitions), skills, and processes (reading, writing counting, dancing, critical thinking, communicating, etc.), and values (Hyman, 1973).

13) A **course** is a unit of study taught (and studied by students) at the tertiary level (source: KBBI) which is prepared based on the ELOs imposed on it, contains learning materials, forms and methods of learning, and assessment, and has a minimum weight of one semester credit unit (credits).

14) **Semester Learning Plan** (RPS) of a course is a learning process plan that is prepared for learning activities for one semester to fulfil the Graduate Learning Outcomes (ELOs) imposed on the course. Semester learning plans or other terms, are determined and developed by lecturers independently or together in a group of expertise in a field of science and/or technology in the study programme.

15) **Learning Assessment Standards** are minimum criteria regarding the assessment of student learning processes and outcomes in order to fulfil Graduate Learning Outcomes (ELOs).

16) **Learning** *experience* is a student's learning activity through interaction with external conditions in their learning environment (Tyler, 1949). Learning activities that transform learning materials into meaningful knowledge that can be used to do new things (Ornstein & Hunkins, 2004) and provide benefits.

17) **Forms of Learning** are learning activities in the form of lectures; responsi and tutorials; seminars; and practicum, studio practice, workshop practice, field practice; work practice, research, design, or development; military training, student exchange, internships, entrepreneurship, and/or other forms of community service Permendikbud No. 3 of 2020: article 14 paragraph 5 (Permendikbud, 2020).

18) **Learning methods** are ways used to realise learning strategies by using as much learning resources as possible including learning media (*a way in achieving something*) (Joyce & Weil, 1980).

19) **Assessment** is one or more processes of identifying, collecting, and preparing data to evaluate the achievement of Graduate Learning Outcomes (LLOs), and curriculum objectives (ABET, 2016). Assessment must be motivational, fostering confidence to contribute to a chosen life path as a lifelong learner. Then use specialised skills to work within their chosen *superteam*.

20) **Learning Evaluation** is one or more processes of interpreting data and evidence accumulated during the assessment process (ABET, 2016).

21) **Curriculum Program Evaluation** as a process or a series of processes of collecting data and information, then analysed and the results are used as a basis for improving the performance of a more optimal and effective curriculum (formative evaluation), or used as a basis for conclusions and decision making (summative evaluation) (Ornstein & Hunkins, 2004).

22) *Assessment criteria* are benchmarks used as a measure or reference for learning achievement in assessment based on predetermined indicators. Assessment criteria are guidelines for assessors so that the assessment is consistent and unbiased. Assessment criteria can be quantitative or qualitative (Brookhart & Nitko, 2015).

23) **Assessment Indicators** are specific and measurable statements that identify the achievement of learning outcomes or performance of student learning outcomes accompanied by evidence.

24) **Data Literacy** is the understanding to read, analyse, use data and information (*big data*) in the digital world.

25) **Technological Literacy** is the understanding of how machines work, and the application of technology (*coding*, *artificial intelligence*, and *engineering principles*).

26) **Human Literacy** is an understanding of humanities, communication, and design.

27) **Forms of** MBKM **Learning Activities** are learning activities outside the study programme that can be followed students for a maximum of three semesters both inside and outside their tertiary institutions, which consist of 9 (nine) forms, including student exchanges, internships / work practices, teaching assistance in educational units, research / research, humanitarian projects, entrepreneurial activities, independent studies / projects, state defence, and building villages / thematic real work courses (Merdeka Belajar Guidebook, 2020).

28) ***Learning Management System* (*LMS*)** is a system used to conduct the learning process by utilising Information and Communication Technology (ICT) and is the result of systematic integration of learning components with regard to quality, learning resources, and quality.

It is characterised by learning interaction (*engagement*) across time and space. The important purpose of the LMS is to provide access and facilities for students to build their knowledge independently and purposefully, and to give lecturers an important role as designers, triggers, facilitators and motivators of learning.

29) **Blended Learning** is a learning approach that harmoniously, structurally and systematically combines the advantages of *face to face* and *online* learning.

30) ***Massive Open Online Courses*** **(MOOCs*)*** is a type of online learning that is attended by a very large number of participants and is open in nature. The most visible characteristic of MOOCs is that it is designed for *self-directed learning/self-paced learning*.

D Purpose of the Student-Centred Learning Implementation Guide

The characteristics of learning in higher education according to the National Higher Education Standards are student-centred, Graduate Learning Outcomes (LLOs) are achieved through a learning process that prioritises the development of creativity, capacity, personality, and student needs, as well as developing independence in seeking and finding knowledge. The diversity of educational backgrounds of lecturers in various study programmes who have not had experience implementing various learning methods needs to be facilitated by the availability of guidelines for implementing student-centred learning methods. For this reason, this guidebook is written with the aim of:

1) to guide lecturers in choosing and applying learning methods in accordance with the characteristics of the field of study and learning materials, and in line with the Main Performance Indicators (KPI) of Higher Education, especially KPI 7 related to collaborative and participatory classes;
2) improve the quality of the learning process and its effectiveness in fulfilling student learning outcomes;
3) increase students' interest in learning through appropriate learning methods; and

4) encourages lecturers to develop innovative learning that can equip 21st century skills to face the challenges of science and technology development.

E Definition of Learning Models, Learning Methods, and Learning Forms

The following definitions of learning model, learning method, and learning form are proposed by Joyce and Weil, and SN-Dikti.

1) Learning model is a pattern of learning that is arranged based on learning principles, theories of psychology, sociology, system analysis and other supporting theories (Joyce & Weil, 1980).
2) Learning methods are ways used to realise learning strategies by using as optimal as possible learning resources including learning media (Learning Methods= *a way in achieving something*) (Joyce & Weil, 1980).
3) Forms of Learning can take the form of lectures, receptions, tutorials, seminars, practicum, studio practice, workshop practice, field practice, work practice, research, military training planning or development, student exchange, internships, entrepreneurship, and/or other forms of community service (SN-Dikti Article 14 paragraph 5).

Each course can use a form of learning by applying models and several learning methods that are in accordance with the Learning Outcomes imposed on the course.

II. CHARACTERISTICS OF THE LEARNING PROCESS

Learning process standards are minimum criteria regarding the implementation of learning in the Study Programme to obtain Graduate Learning Outcomes (LLOs). Meanwhile, learning is defined as the process of student interaction with lecturers and learning resources in a learning environment. Learning process standards in SN-Dikti consist of learning process characteristics, learning process planning, learning process implementation, and student learning load. The characteristics of the learning process include interactive, holistic, integrative, scientific, contextual, thematic, effective, collaborative, and student-centred as illustrated in Figure 2.

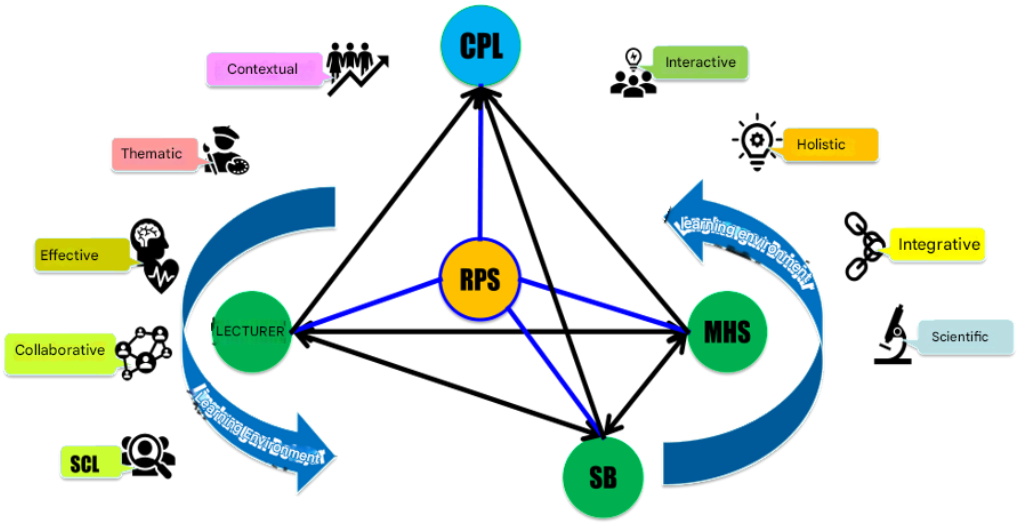


Figure 2. Characteristics of the learning process

These characteristics are intended so that the learning process can obtain Graduate Learning Outcomes (LLOs). Each characteristic is explained in the following description.

A Interactive

Interactive learning is a characteristic of the learning process that states that the Graduate Learning Outcomes (LLOs) are achieved by prioritising a two-way interaction process between students and lecturers. Interactive learning characteristics are one of the learning methods oriented towards student-centred learning.

(*student centred learning*). Active interaction between student-lecturer, and freedom to interact with various learning media is one of the characteristics of this characteristic in facilitating students to achieve Course Learning Outcomes (CPMK) and Graduate Learning Outcomes (CPL).

One example of interactive learning is the *flipped learning* process, where before entering the class, students are required to access various learning resources related to learning topics/materials that will be discussed in class. Before entering the class, students also have the opportunity to actively interact with lecturers/tutors or discuss with fellow students. Students can interact again through various activities such as group discussions, exercises, practices and others in the classroom.

B Holistic

Holistic learning is one of the characteristics of the learning process that encourages the formation of a comprehensive and broad mindset by internalising local and national excellence and wisdom. In the learning process, in understanding information, students are encouraged to relate it to other topics so as to build a comprehensive and broad framework of knowledge. The characteristics of this learning process encourage students to gain learning experience by utilising all the potential of their mind, soul and body actively and effectively.

Holistic characteristics in learning can be exemplified in terms of context-based learning. For example, in learning how to handle a disease outbreak, students also need to understand about the climate, culture and population level in an area.

C Integrative

The Graduate Learning Outcomes (SLOs) are achieved through an integrated learning process to meet the overall Graduate Learning Outcomes (GLOs) in a unified programme through an interdisciplinary and multidisciplinary approach.

An example of integrative characteristics in learning is encouraging the linking of topics and fields with one another.

D Scientific

Graduate Learning Outcomes (LLOs) are achieved through a learning process that prioritises a scientific approach so as to create an academic environment that is based on a system of values, norms, and rules of science and upholds religious and national values.

Learning with scientific characteristics includes the activities of presenting phenomena and formulating problems, formulating hypotheses, designing and collecting data to prove hypotheses, managing and analysing the data obtained, and making conclusions. Not all learning activities can use this approach, but in lectures students need to get learning experiences like experts discovering new knowledge. This experience also trains students to be systematic in solving problems they face in the future.

E Contextual

Graduate Learning Outcomes (SLOs) are achieved through a learning process that is tailored to the demands of the ability to solve problems in their field of expertise. In learning with contextual characteristics, knowledge and skills are acquired by students in accordance with their field of expertise. Contextual learning can also mean that learning materials presented by lecturers are related to real life through REACT activities/strategies, *Relating, Experiencing, Applying, Cooperating, and Transferring* (Davtyan, 2014).

F Thematic

Graduate Learning Outcomes (LLOs) are achieved through a learning process that is tailored to the scientific characteristics of the study programme and is associated with the learning process.

with real problems through a transdisciplinary approach. The principles underlying the learning process characterised by thematic learning are: 1) integrating several study materials in a theme that is in accordance with the scientific field of study; 2) raising real problems related to a theme; 3) solving problems with a transdisciplinary approach involving several disciplines and/or methods; and 4) providing direct experience to students in solving real problems.

The thematic principles are at least reflected in the Semester Learning Plan (RPS) in the form and method of learning and student learning experience. Basically, all student-centred learning methods can integrate thematic principles. For example, using the theme of environmental conservation in science *learning* with *case-based* learning method. Several cases can be raised in learning with theme of environmental conservation, such as cases of *illegal logging*, greenhouse effect, factory waste, and others.

G Effective

Graduate Learning Outcomes (LLOs) are achieved successfully by prioritising the internalisation of material properly and correctly within an optimum period of time. The strategy that can be done for effective learning is to carry out the learning design in accordance with the Graduate Learning Outcomes (LLOs) and Course Learning Outcomes (CPMK) to be achieved. To achieve effective characteristics, a complete and good learning design is needed, including materials, interaction, assessment, and evaluation. Effective learning is shown by the results of process evaluation and learning outcomes.

H Collaborative

The collaborative characteristic states that the Graduate Learning Outcomes (LLOs) are achieved through a shared learning process that involves interaction between individual learners to produce capitalisation of attitudes, knowledge and skills. Shared learning process and interaction

among students to achieve the Graduate Learning Outcomes (LLOs) certainly requires a well-designed learning environment.

Examples of collaborative characteristics in learning can be seen in group discussions, group assignments, group practicum, in which there is interaction between group members and each actively contributes to the group activities.

I Student-centred

The characteristics of student-centred learning are mentioned in SN-Dikti that Graduate Learning Outcomes (SLOs) are achieved through a learning process that prioritises the development of students' creativity, capacity, personality, and needs, as well as developing independence in seeking and finding knowledge.

Student-centred learning is a characteristic of learning that gives an active role to students to improve their ability to learn independently and gives them confidence as adults who are fully responsible for their learning and provide space to develop beyond their designed abilities. With these characteristics, it is expected that study programme graduates will have the ability to learn independently and will become lifelong learners who are able to adapt to changes that occur. On the other hand, educators switch roles to become designers, facilitators, and motivators of the learning process.

III. STUDENT-CENTRED LEARNING METHODS

Student Centered Learning (SCL*)* has long been widely recognised as an approach to learning. Traditional learning that places lecturers as experts and the main source of learning has made the classroom boring for students. Changes in the academic atmosphere are needed so that the student learning process can develop optimally to achieve the expected competencies. The shift in educational paradigm has encouraged a learning process that focuses on lecturers to students.

O'Neil and Mcmahon (2005) concluded that student-centred learning as a concept of student choice in their education, students doing more than lecturers do (active versus passive learning). In a broader sense it describes the power of interaction between students and lecturers. Various methods of *Student Centreed Learning* (SCL*)* were developed but in reality not all of those claimed by educational institutions or educators have been done correctly (Lea et al., 2003). Furthermore, Lea and friends formulated from various sources about the principles of SCL, namely: 1) active rather than passive learning; 2) emphasis on deep learning and understanding; 3) increased responsibility and accountability on students;
4) increased student learning independence; 5) interdependence and mutual respect between lecturers and students; and 6) a reflective approach to the teaching and learning process by both lecturers and students.

A Small Group Discussion

Small Group Discussion (SGD) is a learning method in the form of small groups consisting of 3-5 members. Student group members interact in learning by exchanging ideas, information, experiences, and providing solutions to the problems discussed. The *Small Group Discussion* (SGD) learning method becomes effective if it pays attention to 5 interrelated things, namely: 1) maintaining *positive interdependence*, which means that each member motivates each other in learning interactions; 2) individual accountability.

(*individual accountability*), mutual support and assistance between group members to cover their respective shortcomings and weaknesses. Given that group members may have different abilities and learning speeds; 3) *face to face interaction* between group members to build learning interactions between students and between students and lecturers; 4) each group member acts as a learning resource in the context of learning with peers. Peer learning is often more effective for understanding an idea, solving problems together due to equal levels of communication. This will encourage the growth of *social skills*, including those related to polite behaviour, respecting other people's opinions, learning to listen and not being dominant, as well as having the courage to make suggestions and defend logical thoughts; and 5) *group processing* which focuses on evaluating the extent to which each group member can interact effectively in achieving a common goal, as well as assessing which group members participate or do not participate or which are cooperative and which are not cooperative so that they can be improved in the future.

The lecturer's role is as a facilitator, preparing teaching materials and preparing guidelines for group discussions. In addition, lecturers can act as moderators in discussions, as well as provide reviews and input at the end of the discussion session. Lecturers can also assess each student in mastering the material that has been learned, and can also assess the attitudes and skills demonstrated by students in group discussions. For example, a lecturer can use the *Small Group Discussion* (SGD*)* method to discuss stages of designing a new product that is discussed in groups, then compile writing in the form of a paper that will be presented in front of other groups. Lecturers can assess each group, as well as each student in the group. Assessment can be done both on the mastery of knowledge, attitudes, and skills demonstrated by students. And the assessment can also be carried out by lecturers on the results of group work, for example papers presented by students. Assessment can use rubric or portfolio instruments. The results of the assessment are used by the lecturer to evaluate the mechanisms and procedures of small group discussions for future improvement. Evaluation and reflection can also be carried out at the final session of the *Small Group Discussion* (SGD), by assessing aspects of mastery of material, paper writing structure, presentation, and ability.

answer questions posed in the question and answer process. The results of evaluation and reflection can be used by students to improve their learning outcomes according to the recommendations given by the lecturer.

B Role-Play and Simulation

The learning process sometimes needs to involve students' feelings or emotions, especially to develop *soft skills*, both social and personality, such as caring and partiality based on clear arguments. These *soft skills* can be developed through the application of *role-play* and *simulation* learning methods that facilitate students to learn through role-playing according to scenarios related to real-life phenomena.

Role-Play is a method that facilitates students to learn by acting out a scenario related to real-life phenomena and in accordance with the topic discussed. This method is related to the activities of students dramatising, simulating, playing or acting out, demonstrating real-life cases (Erturk, 2015). Although students play a role with full appreciation (involving feelings and emotions), in this case students are not learning to play a role, but students are learning through role playing (Heyward, 2010). According to McSharry and Jones (2000), there are seven categories of *role-play* methods, namely experimentation/inquiry, *games*, presentation, metaphor, analogy, simulation, and theatre. So according to them, simulation is one of the categories of *role-play*. In this simulation method, students play their respective roles to simulate an activity related to real life. For example, students play the role of interested parties (stakeholders, policy makers, NGOs, etc.) in a discussion about nuclear power plant development plans. The implementation of role-playing in learning can basically be done with the following three main steps (Kodotchigova, 2002).

1. Preparation

In this step, the targeted learning objectives or outcomes, the *role-play* scenario, the roles and the situation or context, the distribution of roles, and the stage setting are discussed. The *role-play* scenario can come from the lecturer or the students (the group that will perform) or the stage.

the results of the class discussion, with the situation or context created in accordance with reality. The division of roles can be done by students, but if the class is still passive it can be done by the lecturer. Students or groups who are not performing can act as . The stage can be set up to resemble reality, such as in a court of law or in a hospital emergency department with appropriate equipment and costumes, but it can also be made simply in front of the class without special equipment and costumes.

2. Implementation

Students individually or in groups play their roles according to the scenario. Students who are not performing act as observers. In addition to observing, the lecturer also makes notes on the implementation of the *role-play* for feedback. During the *role-play*, there should be no intervention or interruption from the lecturer or other observers, but if the game deviates from the scenario that allows dangerous chaos, the lecturer can intervene and even stop the game.

3. Cover

After the *role-play* is completed, a discussion is held on the course of the game. The discussion is directed at two things, namely an evaluation of the course of the game whose results can be used as material for reflection to be followed up on the implementation of the next *role-play*, and an evaluation to see how far the implementation of *role-play* can achieve student learning targets for both those who become actors/players and observers.

In the application of *role-play* and *simulation* learning, the roles of lecturers and students respectively include the following.

The role of the lecturer

1) prepare topics or cases and draft scenarios class discussion;
2) prepare a draft of the *role-play* rules for discussion and agreement;
3) observe and supervise the *role-play*; and

4) facilitate the discussion after the *role-play* and provide *feedback* on the *role-play*.

Student role

1) study the topic material to support the *role-play*;
2) discuss or study the *role-play* scenario;
3) prepare the equipment for the *role-play*;
4) play the role according to the scenario, while students who are not playing the role observe the *role-play*; and
5) discuss and summarise the results of the *role-play*.

Advantages and disadvantages method learning *role-play* and *simulation* is as follows.

Excellence

1) increased interaction between students, as each group had to have a discussion before and after the role play;
2) train students' skills and responsibility in managing a performance activity;
3) Train students' courage to act out a case that is in accordance with reality;
4) bring learning situations closer to real-life situations;
5) engage students' emotions so that it is suitable for teaching social and personality attitudes; and
6) practice communication and argumentation skills.

Weaknesses

1) It takes a longer time, from preparation to performance and evaluation discussion;
2) It is a burden for shy students to role-play;
3) boring for students who are less sociable; and
4) Success implementation very depends on readiness and sincerity of the students playing the roles.

The application of the role-playing learning method, for example, in order to achieve learning outcomes on radioactivity, students are assigned to play the role of a television presenter delivering information related to radioactivity in a language that can be understood by viewers. Another example, a group of medical or nursing students play a role about handling traffic accidents in an emergency department.

C Case Based Learning *(CBL)*

Many problems can be encountered in everyday life, whether at home / family, community, or workplace. Among these problems, some can be solved properly and there are even several alternative solutions that can be taken, but not a few problems are complex and difficult to solve so that no solution is considered good. To provide learning experience to students in solving problems in the context of the real world, cases of problems around us that are relevant to the field of study can be raised in learning.

Case-based learning is a method that engages students in real-world situations presented in learning to improve problem-solving and decision-making skills. Active learning that focuses on a case involves students *learning by doing*. Cases can be real or fabricated stories relevant to the study material or retell events, problems, dilemmas, theoretical or conceptual issues that require analysis and/or decision-making (Kemdikbudristek, 2021).

In general, the things that need to be considered in the *case method*: 1) students take on the role of the "protagonist" trying to solve a case; 2) students analyse the case to develop a recommended solution, assisted by group discussions to test and develop the draft solution; and 3) students take on the role of the protagonist.
3) The class had an active discussion, with the majority of the conversation being conducted by the students, while the lecturer only facilitated by directing the discussion, asking questions, and observing.

The problem in a case is presented in narrative form to be studied or discussed for alternative solutions. The case can be taken from the real world or it can be a contextualised artificial case. For example, the Lapindo mud case, the case of the decline in the performance of a company, the case of the implementation of a policy, and others.

The principles of case-based learning in higher education include the following:

1) using real problem cases described in narrative form with sufficient information or data;

2) facilitate students to apply their knowledge in a real-world context; and
3) involves students mentally experiencing a situation in a real case and attempting to find a solution.

In implementing *Case-Based Learning* (CBL) in the classroom, there are several steps or stages that are carried out, namely preparation, implementation (core activities), and closing. The explanation of each step is as follows.

1. Preparation

In this preparation stage, the lecturer identifies and compiles the case to be discussed in the form of a written narrative, determines the procedure and alternative problem solving, prepares the classroom layout according to the needs for group discussion. Students are assigned to prepare various literature sources in accordance with the case to be discussed.

2. Implementation

Lecturers begin the activity by explaining the learning outcomes and achievement scenarios, preparing the class, distributing cases, facilitating and observing group discussions. Students in groups identify problems and information or data both available in the case and from the literature, analyse information / data to find alternative solutions to the problem, decide the best choice of problem solving.

3. Cover

At this stage a class discussion is held, each group presents the results of problem solving from the case that is the task. The lecturer gave reinforcement to the conclusions or results of problem solving and conducted a joint reflection on the implementation of the discussion including its strengths and weaknesses.

In the implementation of case-based learning, the roles of lecturers and students respectively include the following.

The role of the lecturer

1) prepare cases that will be discussed based on the learning outcomes to be achieved in the course;
2) determine the procedure for discussing the case study, whether it will be analysed individually or in groups, and the time allotted for discussing the case in groups;
3) During the group discussion process, the lecturer is only in charge of observing, except when necessary to provide additional information needed by the group;
4) The key to the success of case studies is the "involvement" of students, therefore lecturers need to pay attention so that each student has an equal opportunity to actively participate;
5) after the group discussion time is over, the lecturer calls the group to regroup in the form of a class discussion and each reports the results of its discussion in the form of the results of the analysis and solution of the selected problem; and
6) The lecturer then summarises and concludes the learning outcomes and gives notes on the implementation of the discussion. This opportunity can also be used to bridge theory and practice. The lecturer can clarify (reinforce) what the group has learnt and ask the group about their impressions as a reflection on the learning process and outcomes.

Student role

1) prepare various literature sources in accordance with the case to be discussed;
2) take into account the case-based learning outcomes that will be implemented;
3) receive a case study that is assigned to their group, followed by discussing and analysing it to find alternative solutions and determine the best problem-solving option; and
4) present the problem solving of the assigned case study in a class discussion forum.

The advantages and disadvantages of case-based learning method are as follows.

Excellence

1) train students to learn contextually;
2) train students to think critically;
3) introduce problem-solving and decision-making procedures;
4) provides an opportunity for students to integrate *prior knowledge* with the problems in the case in order to learn to make professional decisions;
5) provide opportunities for students to explore their potential and develop concepts/ideas; and
6) provide opportunities for students to appreciate the values of tolerance, respect for other people's opinions, and democracy.

Weaknesses

1) learning will not run optimally, if they have not mastered the material and cases presented because students are required to think critically;
2) learning is boring for passive students;
3) requires a long time in learning and managing class dynamics; and
4) Learning cannot be carried out well if the lecturer is not creative and actively looking for relevant cases.

The topic comes from a real case, for example a case that has happened or is happening in an institution or company. A case that has occurred in a company and was successfully handled can be used as an example of case resolution at the beginning of the implementation of case-based learning in the classroom. This activity can be started with a field task to find information related to the success of the company in handling the case, for example by interviewing the company. This example can be continued by giving group assignments to students to find alternative solutions, beyond the solutions that have been successfully taken by the company.

D Collaborative Learning *(CL)*

One of the much-needed 21st century competencies is the ability to collaborate. This ability needs to be honed through various efforts to create a conducive learning environment.

Collaborative Learning (CL) is a learning method that emphasises on cooperation between students based on agreements that are built by themselves with group members. The problem/task/case does come from the lecturer and is *open ended*, but the formation of groups based on interest, group work procedures, determining the time and place of discussion/group work, up to how the results of discussion/group work are to be assessed by the lecturer, are all determined through mutual consensus among group members.

Klemm (1994) states that *Collaborative Learning* (CL) has characteristics that include: 1) positive dependence, 2) interaction, 3) individual and group accountability, 4) interpersonal skills development, 5) heterogeneous group formation, 6) knowledge sharing between lecturers and students, 7) authority or role sharing between lecturers and students, and 8) lecturer as mediator.

The main reason and at the same time the advantage of applying the *Collaborative Learning* (CL) method is that students can have the ability to work together, tolerance, mutual need, mutual motivation, and foster leadership. *Collaborative Learning* (CL) can also provide students with broad knowledge and insights from their experience of learning in groups, studying and analysing problems from various perspectives. The limitation of the collaborative method is that it will be difficult to apply to classes that do not have adequate knowledge and skills, especially in early classes that are still in the stage of adaptation and socialisation. This method is not successful if the lecturer does not have the ability to motivate and manage the group well.

The success of the *Collaborative Learning* (CL) method is largely determined by the preparation and initial conditioning of the materials, participants and facilitators. The preparation of the *Collaborative Learning* (CL) method lesson plan includes the following:

1. *Course Design*

This section contains the title, objectives, topics, and how the course is organised.

sequence activities which will To do students in completing the tasks in groups.

2. *Learning Outcomes*

The learning outcomes of *Collaborative Learning* (CL) method at least include students' ability : 1) gain respect, 2) appreciate opinions and tolerance, 3) create networks, 4) share ideas and opinions, 5) make joint decisions, 6) time management, and 7) add new perspectives.

3. *Material Selection*

This activity includes: 1) the design of the task is open, 2) the work on the task begins with reading a number of materials or theoretical concepts related to the task to be done together, and 3) the results of the reading are discussed again to get agreement.

4. *Facilitator*

The things that the facilitator needs to be prepared for are: 1) the ability to design open-ended tasks, 2) the ability to motivate (provide instructions around learning together in groups), and 3) the ability to act as a facilitator.

5. *Learning Participants*

The things that students need to have are: 1) an initial understanding of the task to be done, 2) the ability to work together with their group members, and 3) the ability to discuss and analyse.

6. *Learning Materials and Resources*

Materials and resources prepared include: 1) tasks designed by lecturers and students, 2) main materials, and 3) supporting materials.

7. Facilities and Infrastructure

The facilities and infrastructure required include: 1) lecture theatre adequate so that students can be divided into groups, 2) group work and discussion spaces complete with equipment, 3) libraries, and 4) laboratories.

8. Assessment Plan

This section is an important part of the *Collaborative Learning* (CL) method so that the achievement of objectives can be measured validly. This part requires formulating indicators and assessment criteria as well as developing assessment tools in the form of rubrics or portfolios. Assessment and evaluation of the *Collaborative Learning* (CL) method can be done on many aspects, not only on cognitive learning outcomes. For example, evaluation can be done on students' ability to discuss. Due to observation limitations, lecturers can choose *peer evaluation*.

E Cooperative Learning *(CoL)*

Cooperative Learning (CoL) is a learning method conducted in groups and designed by lecturers to solve a problem or case. The group formed consists of several students, who have diverse academic abilities. The group is divided into several students (usually small groups) proportionally according to the design of the problem or case to be solved.

This method is very structured because the formation of groups, the material discussed, the steps of discussion, as well as the final product that must be produced, are all designed by the lecturer. Students in this case play an active role in the discussion and follow the guidelines designed by the lecturer.

benefits of *Cooperative Learning* (CoL) include:

1) encourage active learning habits in students;
2) increase students' sense of individual and group responsibility;
3) improve the ability and skills of co-operation between students; and

4) improve students' social skills.

Cooperative Learning (CoL) is implemented in several steps as follows:

1) lecturer set up a problem/case or form task to be solved by students in groups;
2) lecturers design the learning process;
3) The lecturer presents the objectives and motivates the students;
4) lecturer presents information or concepts of learning materials;
5) lecturers organise students into study groups; and
6) The lecturer guides and monitors the learning groups, evaluates work, and assesses the presentation of group results.

According to Lie (2007), the principles of *Cooperative Learning* (CoL) are positive interdependence, individual responsibility, communication between members, and group process evaluation. The *Cooperative Learning* (CoL) process is conducted between students and lecturers through interactions of mutual respect and appreciation. The roles performed by students in the *Cooperative Learning* (CoL) process include:

1) discuss and conclude the problem/case given by the lecturer in groups;
2) do the work of assignments and materials given by lecturers; and
3) do and complete learning materials in groups.

One of the evaluation models according to Denise M. Woods and Kuan-Chou Chen (2010) is the *Cooperative Learning* (CoL) evaluation model. This evaluation emphasises interdependence between students. *Cooperation* is a very important requirement so that the procedures of the *Cooperative Learning* (CoL) evaluation system include personal and group responsibility.

Similarities between *Cooperative Learning* (CoL) and *Collaborative Learning*
(CL) among others:

1) requires active student participation;
2) demanding responsibility for the learning process;
3) requires the role of the lecturer as a facilitator;
4) requires an accurate task or case plan;
5) builds teamwork and social interaction skills;
6) preparing students for the world of work;
7) improve thinking skills;

8) share learning experiences;
9) improve knowledge retention; and
10) improve mutual respect.

The difference between *Cooperative Learning* (CoL) and *Collaborative Learning* (CL) can be presented in Table 1 (L, S, Davidson, & Hawkes, 1995).

Table 1 Differences between *Cooperative Learning* (CoL) and *Collaborative Learning* (CL)

***Cooperative* Learning/CoL**	***Collaborative* Learning/CL**
CoL is conducted to achieve a predetermined/given goal. Each group member has an equal share of the task and later there will be a forum to show the results of the task. In this case, students will get a perspective or point of view from other group members.	CL is conducted to achieve a predetermined/given goal and each group member has a different part of the task to complement each other.
Activities are structured by the lecturer by assigning roles to each student.	Students organise their own roles within their groups.
Lecturers provide materials for students to read and analyse.	Students search for materials to help solve the problem (case).

F Project Based Learning *(*PJBL*)*

Project-based learning facilitates students to work on tasks (in the form of projects) that have been systematically designed, then demonstrate performance and be accountable for the results of group work in the form of products. The form of learning activities is to design a systematic task (project) so that students learn knowledge and skills through a structured and complex *inquiry* process, then formulate and carry out the process of guidance and assessment.

The *Project Based Learning* (PjBL) method in the curriculum is at least implemented after the 2nd semester, because students must

get theoretical provision first. In *Bloom*'s taxonomy, *Project Based Learning* (PjBL) is included in the ability level of applying, analysing, evaluating, and creating. The project may be a combination of several courses applied to solve a particular problem. At first the problem must be clearly defined, if necessary the series of activities are described using a flow chart and then the design is in the form of a block diagram. Each part of the block diagram needs to be clarified so that it can be tested for conformity.

All these steps must be written in the form of reports and presentations, so that the results can be presented in a discussion forum as a form of responsibility that the project has been successfully completed. The discussion also allows for constructive feedback with the aim of completing the project better.

The application of *Project Based Learning* (PjBL) can provide authentic experience for students in developing problem-solving skills in everyday life through cooperation and communication. This authentic experience is what graduates need to be able to compete in the world of work. This statement is supported by the results of research which reveal that the *Project Based Learning* (PjBL) method can prepare graduates who are ready to enter the world of work compared to verification learning methods, and can develop *life-skills* for students (Jollands, Jolly, & Molyneaux, 2012); (Wurdinger & Qureshi, 2015).

According to Cahyono et al. (2020)**,** *Project Based Learning* (PjBL) can run well and smoothly with the requirement that students already have prior knowledge or skills.

The learning steps in Project-Based Learning according to the stages developed by the George Lucas Educational Foundation (2005) are:

1) *Start With the Essential Question.* Learning begins by providing essential questions raised from real problems in accordance with the learning material. This problem is expected to be in accordance with the latest developments and interesting for students to solve. The problems to be solved are agreed upon in student groups with the guidance of the lecturer.

2) *Design a Plan for the Project* Plan to solve the problem through an agreed project so that each group member has a sense of responsibility for the completion of the project. The design must take into account the conditions of the students' abilities as well as the equipment, infrastructure and facilities that allow for the implementation of the project.
3) *Create Schedule* Lecturers and students agree on a project completion schedule consisting of components, stages and time of project completion, and activities in project completion.
4) *Monitor the Students and the Progress of the Project* Lecturers monitor the progress of student project completion, both the activities and the quality of the project products according to the set standards. Important activities are recorded for discussion and assessment.
5) *Assess the Outcome* Assessment of aspects of attitude, knowledge and skills in accordance with the Learning Outcomes charged in the course. Students in groups present the products produced to solve relevant problems. Students' active participation in project completion and discussion, as well as product quality are also assessed with appropriate techniques and instruments.
6) *Evaluate the Experience*. At this stage, students reflect on their learning experience. In groups and individually, students express their experiences in a discussion. Input from lecturers and other students becomes a record for improving performance and project products. In the end, students realise how to discover new concepts through the process of inquiry.

In summary, the implementation stages of the project-based learning method are presented in Figure 3.

Learning stages using *Project-Based Learning* (PjBL) method

The characteristics of the *Project Based Learning* (PjBL) method according to Guo, et al. (2020) can be characterised by the following aspects.

1) Driving question
   a) driving questions have links to the real world and interesting student experiences;
   b) Encouraging questions are open and challenging for students to complete their intellectual tasks according to their knowledge and skills.
2) Learning Objectives
   a) Project-based learning allows students to learn new study materials and skills as required by the curriculum;
   b) Project-based learning requires longer learning time than conventional learning;
   c) In order for students to have a good understanding of concepts, answer problems and collaborate, more than one meeting is needed.
3) Scientific Experience
   a) Students actively perform the stages of the scientific method that they designed to solve the problem;
   b) the scientific experience is *inquiry-based learning*
      which consists of the following stages.
      - Orientation to the topic: students have a specific problem to study that they need to solve;
      - Conceptualisation: presents research questions and presents hypotheses (if any);
      - Investigation: exploration (if there is only a research question but no hypothesis) or conducting an experiment (if there is a hypothesis), followed by interpretation of the data obtained;
      - Conclusions: students draw conclusions based on the data collected;
      - discussion: communicating results;
      - reflection

4) Collaboration

   In carrying out the project students collaborate with each other, also practising communication skills. Collaboration should be seen as a means to achieve the main goals of learning, practising science, understanding concepts, and learning how scientific knowledge is created and used.

5) Using technology

   Students use technology in data collection, data analysis and presentation. Lecturers use technology in delivering learning materials, facilitating project completion, in conducting monitoring and assessment.

6) Produce products

   a) The learning process is focussed on making a product as a solution to a problem. Making a product as a result of the project is what distinguishes the *problem-based learning* method;

   b) The products produced must be:

      - answer the problem or driving question;
      - reveal students' level of concept understanding;
      - help students to master the concepts of the study material learnt;
      - meaningful;
      - Project-based learning allows students to produce a variety of products, but culminates in solving a problem or answering a driving question.

The application of *Project Based Learning* (PjBL) method in chemistry learning has several advantages for students, among others: 1) increasing student motivation to learn, 2) increasing problem solving skills, 3) increasing student skills to seek and obtain information, 4) developing and practicing communication and collaboration skills, 5) providing experience to students learning and practice in organising projects, making time allocations and other resources, 6) providing learning experiences to retrieve information and demonstrate the knowledge they have, then implemented with the real world, and 7) creating a pleasant learning atmosphere.

Project Based Learning (PjBL) in addition to having advantages, learning also has several disadvantages including: 1) requires a lot of time to solve the problem, 2) requires a lot of money, 3) students who have weaknesses in experiments and information gathering will experience difficulties, and 4) when the topics given to each group are different, it is feared that students will not master the learning material comprehensively. To overcome the weaknesses of *Project Based Learning* (PjBL), it can be done.

by facilitating students in dealing with problems, limiting students' time in completing projects, and providing simple equipment found in the surrounding environment, choosing research locations that are easy to reach so that it does not require a lot of time and money, creating a pleasant learning atmosphere so that lecturers and students feel comfortable in the learning process.

The stages in the implementation of *team-based project* learning are as follows:

1) The class is divided into groups of more than 1 (one) student to work on the task together for a specified period of time;
2) groups are given a real-life community problem or complex question, and then given the space to create a work plan and method of collaboration;
3) each group prepares a final presentation/work that is displayed in front of the lecturer, class, or other audience that can provide constructive feedback; and
4) The lecturer mentors each group during the project work period and encourages students to think critically and creatively in collaboration.

G Learning Based Problem (Problem Based Learning (PBL)

The Problem Based Learning (PBL) method is a learning method that challenges students to solve real-world problems. Students must actively dig / search for information (*inquiry*) and use the information obtained to solve problems / cases that must be solved. The expectation for students through this learning method is to have certain competences in solving a problem in the real world. For this reason, making cases must fulfil several aspects so that the objectives of applying the *Problem Based Learning* (PBL) method are achieved.

The problems raised are authentic, meaning that the problems given come from the real world and are rooted in the principles of certain disciplines. The problems are presented clearly, easy to understand, cover all the material taught in accordance with the time, space, and resources available. The problem solving is useful for students.

For example, in the *Event Management / MICE* course, a student is expected to have competence as an *event organiser*. In an effort to achieve these goals, the *Problem Based Learning* (PBL) method is carried out through the preparation of a problem designed by lecturers that contains real problems in managing an *event* or by providing problems that do occur in the real world. In this case, the information obtained by students greatly determines the ability of students to solve these problems. In the real world, the success indicator of organising an *event* can be seen from the preparation stage, the implementation stage of the activity and the post-implementation of the activity. Problems that usually occur are unprofessional committees, speakers or guest stars who suddenly cancel, participants or *audiences* who are not orderly, *sponsors* who default to schedules that may have to be rescheduled. Students will be assessed on their ability to solve existing problems based on each stage of organising an *event*. Technical instructions for solving a case must be well prepared by a lecturer in charge of the course so that the problem / case solving is as expected.

H Discovery Learning and Inquiry

Many questions or problems that arise in everyday life require scientific information in solving them. Questions that disturb curiosity or efforts to fulfil needs have encouraged scientists or experts to carry out a process of scientific investigation or scientific work (*doing science*) on the questions or problems they face, until a solution or scientific product is found. The habit of working scientifically makes scientists skilled at solving their problems, even problems outside their field in everyday life. Starting from these advantages, there is an effort to apply the habits of scientists in scientific work in learning. This is important because the problems in our lives today are increasing and complex. The learning process that facilitates students to find their own knowledge or solution to a problem, as scientists usually do, is called inquiry learning.

Inquiry can be defined as the process of seeking information, solutions, or knowledge by questioning a phenomenon or knowledge.

situation. Inquiry learning is a method that facilitates students to work like scientists in questioning why phenomena occur, then trying to collect data or information and analyse it followed by drawing conclusions, so that finally students can find their own answers to a problem (Wiyanto, 2008).

The principles of inquiry learning are as follows:

1) Students are faced with a problem or phenomenon or description of the situation as a stimulus that disturbs their curiosity;
2) Students are facilitated to solve problems until they find the solution themselves;
3) students conduct hands-on activities related to the process of collecting information or data to solve problems; and
4) students facilitated by to develop ability *data-driven* inductive thinking.

Trowbridge et al. (1981) distinguish inquiry strategies from discovery strategies. Discovery is the mental process of assimilating concepts and principles. The *discovery* process includes: observing, classifying, measuring, predicting, describing, and concluding. Meanwhile, inquiry is process of uncovering and investigating problems, formulating hypotheses, designing experiments, collecting and analysing data, and drawing conclusions.

Trowbridge and Bybee (1990) distinguish the inquiry approach in three levels. The first level is called discovery, where the lecturer determines the problem and the process of solving it, while students work on the process that has been determined by the lecturer until they can find the solution themselves. The second level is called *guided inquiry*, where the lecturer poses a problem, while students determine the problem-solving process themselves and carry out the problem-solving process until the solution is obtained. The third level is called *open inquiry*, where the lecturer only provides a vehicle to stimulate problem solving, while students identify and formulate problems, design the solution process, carry out the process until the solution is obtained.

Steps or stages in implementing *discovery/inquiry learning* in the classroom has at least 6 steps.

1. *Stimulation*

At this stage students are faced with something (object or
A phenomenon that raises a question mark, which can arouse students to think critically about the phenomenon, so that the desire to investigate for themselves arises. In addition, lecturers can start the teaching and learning process (PBM) by asking questions, recommending reading books, and other learning activities that lead to preparation for problem solving.

2. *Problem Identification and Hypothesis Submission*

After stimulation, the next step is for the lecturer to provide opportunities for students to identify as many problem agendas as possible that are relevant to the subject matter, then one of them is selected and the problem is formulated in the form of a question. The selected problem is then followed up by proposing alternative temporary answers or hypotheses. The hypothesis proposed is based on the knowledge possessed by students (*theory-driven*). The process of proposing hypotheses requires student creativity.

3. *Data Collection*

Hypothesis testing requires data support. This stage is the stage of designing experiments (or ways of testing hypotheses) and their implementation for data collection in order to answer questions or test hypotheses. Students are given the opportunity to objectively collect various relevant data/information, read literature, observe objects, interview sources, conduct their own trials, and others in accordance with the design. So, at this stage students actively and objectively seek and test reliable data/information to test the hypothesis. Designing experiments or ways of testing hypotheses is a creative process, so it is expected that student creativity will develop. In addition, a sceptical attitude is also developed, namely not believing in information that is not supported by data, and also objective attitude, namely looking at something (especially in measurement or data collection) without prejudice (not "biased").

4. Data Processing

At this stage, the data that has been collected is processed, classified or classified.

The data is categorised, displayed in the form of tables, graphs or diagrams. Relationships between data are analysed to see the deductive consequences of hypotheses.

5. Hypothesis Testing

At this stage, students carefully examine the results of data processing and relate them to the hypothesis that was proposed at the beginning. If the data supports the hypothesis, the hypothesis is accepted, but if the data does not support it, the hypothesis needs to be modified or replaced.

6. Inference

At this stage, students draw conclusions that can be used as general principles and apply to all the same events or problems. Drawing conclusions is based on the results of data verification and its support for the hypothesis.

In the application of *inquiry/discovery* learning, the roles of lecturers and students respectively include the following.

The role of the lecturer

1) prepare a problem stimulus that can arouse students' curiosity;
2) facilitate students in group formation;
3) deliver stimulus to students;
4) facilitate, observe, and monitor student activities; and
5) facilitate and observe the implementation of the class presentation/discussion until it reaches a conclusion.

Student role

1) form groups for the implementation of learning activities *inquiry/discovery*;
2) Observe the stimulus delivered by lecturer, followed by formulating the problem;
3) formulate/propose a hypothesis;
4) design activities/experiments in order to test the hypothesis;

5) carry out the design of activities/experiments for data collection;
6) process data and conduct hypothesis testing;
7) drawing conclusions based on hypotheses and the results of data analysis or verification; and
8) play an active role in class discussions after *inquiry/discovery* activities.

Based on the observation, the application of *discovery/inquiry* learning has advantages and disadvantages, including the following.

Excellence

1) foster students' scepticism, objectivity, curiosity, critical and creative thinking;
2) foster problem-solving skills and learn to learn;
3) foster the ability to work together in a team;
4) foster communication skills (presentation and discussion);
5) improve skills in using measuring instruments;
6) Because students discover concepts by themselves, learning becomes memorable and learning outcomes can be stored longer in memory;
7) Hypothesis testing activities can be used to dispel doubts and even to remediate misconceptions.

Weaknesses

1) For students who are less good or less familiar, they will have difficulty in expressing the relationship between concepts, which can cause frustration;
2) It is not efficient for a large number of students, as it takes a long time to help them discover concepts or theories or solve other problems on their own;
3) In some disciplines, for example in the field of science, there may be a lack of facilities for measuring/collecting data needed in hypothesis testing.

An example of its application in learning Physics, among others, through inquiry laboratory activities students are facilitated to find their own relationships between several physical quantities, for example the relationship between the amount of acceleration (a) and the amount of force (F) acting on an object. Or, students are facilitated to find their own factors or quantities that affect a physics process. Another example in the social field in

In learning History, students are facilitated to find their own linkages between cultures from one era to the next. The process of finding connections can be facilitated through wiki *tools* on the *learning management system* (LMS).

I Self-Directed Learning *(SDL)*

Self-Directed *Learning* (SDL) is learning that allows individuals to take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning outcomes, identifying learning resources, selecting and implementing appropriate learning strategies, and evaluating learning outcomes. In the 21st century learning requires the ability to learn independently so this method is very strategic to apply.

The notion of *Self-Directed Learning* (SDL) continues to develop, vary and expand according to the academic tradition of the author (Olivier, 2020). Self-directed learning can be considered as part of the movement towards student-centred learning that emphasises increasing student responsibility. The use of technology affects the way of thinking and causes students to be more independent, therefore students should be encouraged to search, discuss and experiment with applications or software, and other useful tools, including that may not be previously known.

Stages need to be planned to develop a *Self-Directed Learning* (SDL) programme. The following five basic elements can be followed sequentially as steps in the process of developing *Self-Directed Learning* (SDL) (Gibbons, 2002):

1) identify learning outcomes;
2) creating a suitable environment for the learning process;
3) equip students with the skills and experience necessary to fulfil the learning outcomes;
4) discuss with each student the proposal, contract, or plan that has been prepared to fulfil the Graduate Learning Outcomes (LLOs) and their individual goals; and
5) establish processes for student self-assessment, procedures, and monitoring their learning progress.

The *Self-Directed Learning* (SDL) method gives students the awareness that the actions they take and think about during the learning process are their own responsibility. The assumptions that must be fulfilled to apply the *Self-Directed Learning* (SDL) learning method are as follows:

1) students as adults, becoming individuals who are able to learn independently and not depend on others;
2) experience becomes a very useful source of learning;
3) learning readiness is necessary to start becoming an independent learner;
4) learning from a problem is more interesting to adults than course content; and
5) Good relationships and interactions between lecturers and students, complementing and strengthening each other. The learning atmosphere for adults is built through recognition, appreciation and support of the learning process.

In *Discovery Learning*, lecturers play a role in developing knowledge and skills that cannot be obtained or students have difficulty in understanding a concept/theory. *Self-Directed Learning* (SDL) does not completely release students in learning, the role of lecturers is very important as experts who master the material and lead students, as well as mentors who direct and guide students.

Based on facts and observations, the application of the SDL approach in learning has advantages and disadvantages. The advantages of the *Self-Directed Learning* (SDL) method include that students can: 1) learn according to their learning style, interests and talents, 2) learn from various learning resources that meet the criteria, 3) learn material that is their specialisation, and 4) develop knowledge and skills comprehensively. While the weaknesses of the *Self-Directed Learning* (SDL) method are: 1) students who are less active and slow will be left behind, and 2) students can have difficulty in choosing the right material and learning method if they have not recognised their own potential and interests.

The process of *Self-Directed Learning* (SDL) is very flexible but still in the stages of *planning*, *monitoring*, and *evaluating* which depends on the ability of students to manage their learning. Assessment of results

Learning with *Self-Directed Learning* (SDL) cannot be done simultaneously due to the diversity of each student's learning process. Lecturers provide time to prepare evaluation and feedback for each student.

J Contextual Instruction *(CI)*

In *Contextual Instruction* (CI), students learn concepts/theories that are related to real situations and conduct field studies to study the suitability of concepts/theories with the realities they encounter in life. Contextual learning is method that helps students understand what they learn by connecting the study material with the context of their lives (Johnson, 2002). Furthermore, Johnson (2002) conveyed strategies for learning with contextual methods including *Relating, Experiencing, Applying, Cooperating and Transferring* (REACT).

Relating is the most important contextualised learning strategy, as it is also a central part of constructivist learning. Students learn in the context of their life experiences or pre-existing knowledge. At this stage students connect new information with life experiences or prior knowledge brought to the classroom. It is therefore important to identify whether students have related experience/knowledge which is usually expressed as apperception and preconception. If students do not have prior experience or knowledge then lecturers can organise direct experience in the classroom through demonstrations, video shows or other forms related to events or phenomena that exist in students' lives. In learning carbohydrates in organic chemistry courses, students will quickly answer if asked about food or drinks that taste sweet. What causes the sweet taste? Is what causes the sweet taste definitely carbohydrates?

Experiencing, students learn by doing through exploration and discovery. Direct experience in the classroom can be done through manipulatives, problem-solving activities, and laboratory activities. To prove that the sweet taste in a food or drink comes from carbohydrates (sugar) then can be done

general test experiments for the presence of carbohydrates and identification of types of carbohydrates.

Applying, students apply the concepts they learn through problem-solving project activities, lecturers guide and motivate. Students can be given a project to identify the types of carbohydrates in drinks or beverages that are often consumed in everyday life. Students are also challenged to prove that sweetness is not always from sugar.

Cooperating, students work together in groups to complete exercises or real-life experiences. Students in the group share, respond, and communicate. In the process of solving problems through the project, students work together to divide the work in finding samples, determining test methods, and conducting tests to conclude.

Transferring is a learning strategy to use knowledge in a new context or new situation that has not been discussed in class. Students get new experiences and knowledge after passing the *Relating, Experiencing, Applying and Cooperating* strategies. Lecturers provide opportunities for students to convey new experiences and knowledge gained in the classroom.

The findings obtained by each group were presented, discussed and summarised into new knowledge gained through the REACT strategy.

IV. IMPLEMENTATION OF STUDENT-CENTRED LEARNING USING INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

The development of Information and Communication Technology (ICT), especially technology that supports learning, is growing very rapidly. The ease of the process of developing videos and digital learning media encourages the growth of digital content. One implementation of student-centred learning that is relevant today is learning with a *flipped* learning strategy. Likewise, in 21st century learning, students are required to have the ability to learn independently as discussed in this section of the chapter.

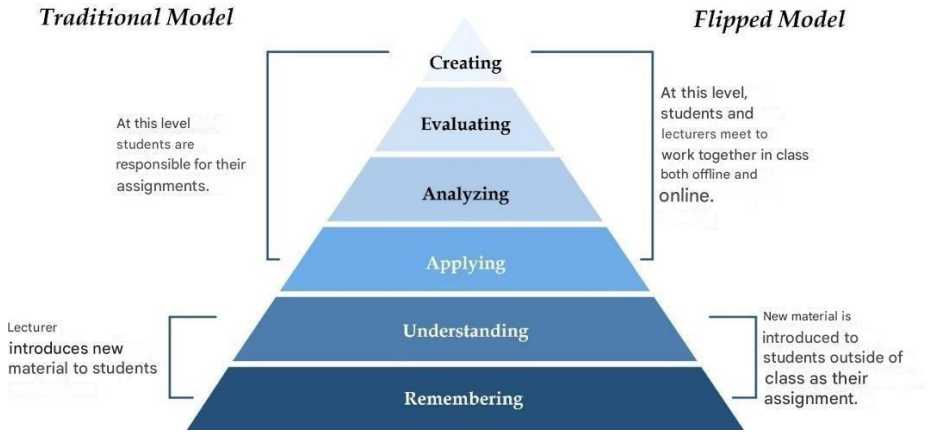
A Flipped Learning

Traditional learning with a one-way approach utilises meetings with students only to explain the material and ends with assignments or homework. The next meeting repeats the same approach and may miss out on discussing assignments that actually lead to the achievement of *high order thinking skills* (*HOTS*). The development of ICT has caused the old approach to evolve again. This can be seen with the possibility of lecturers recording and creating interactive materials. The material can be studied by students before the class meeting, so that class meeting is utilised for discussion and clarification. Learning with this approach is called *flipped* learning.

Some terms that have the same meaning with *flipped learning* are *flipped classroom, flipped model, inverted model*. *Flipped learning* is defined as a pedagogical approach, where direct learning (one-way) is done outside the classroom, so that the time in the classroom can be filled with active group learning and encourage learners' creativity on a teaching material (*Flipped Learning Network* (FLN, 2014)). The definition of *flipped learning* is illustrated in Figure 4.

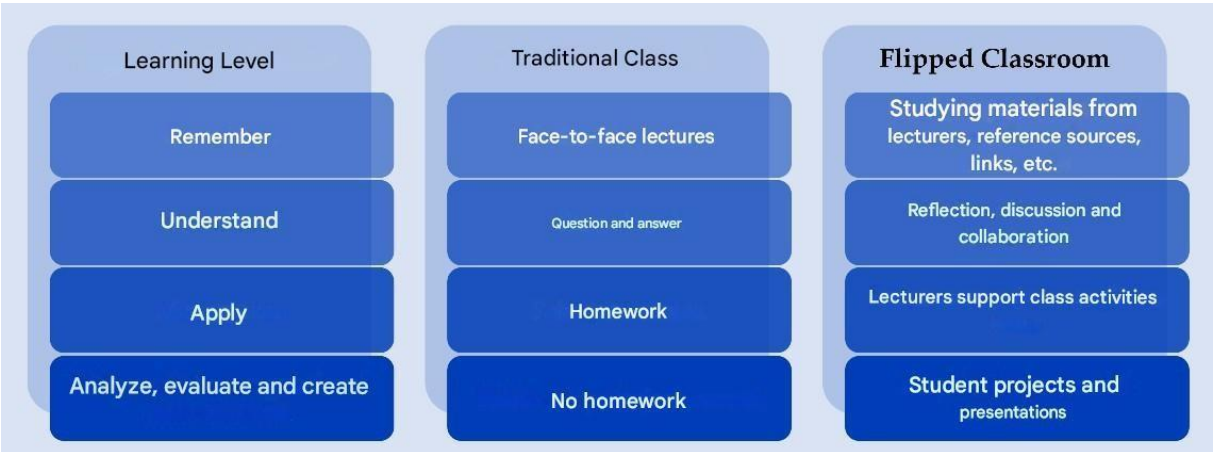
Illustration of *flipped learning*

Figure 5 shows the difference between traditional and *flipped learning in* relation to the achievement of thinking skills (using Bloom *Revised* Taxonomy).



The difference between traditional method and *flipped learning* terms of level achievement in Bloom *Revised* Taxonomy

The description of learning levels according to Bloom's Taxonomy relevant to traditional and *flipped learning* activities is shown in Figure 6.



Learning activities in traditional and *flipped learning* methods

B Self-Paced Learning

Self-paced *learning*, also known as *individualised learning* or *self-instruction*, is a learning method where students work at their own pace and actively undertake various learning tasks/activities and learning experiences to achieve learning outcomes.

Since all control is on the students, the most important element in *self-paced learning* is the responsibility, speed, and success of students in learning based on learning outcomes and various activities supported by available resources. In this case, educators/lecturers need to determine the learning outcomes and set various requirements that must be fulfilled by students. Thus, success in the application of this *self-paced learning* method requires a good and complete learning design, in accordance with the learning outcomes and contains various learning activities tailored to the characteristics, preparation, needs, and individual interests of each student. The implementation of this method generally requires a computer-based *learning management system*, which can be used to track the *learning* progress of each student and to select appropriate learning outcomes.

The rapid development of Information and Communication Technology (ICT) in the last decade has encouraged the utilisation of ICT in various fields, including learning technology. The utilisation of internet technology in learning has made it easier to learn anywhere, anytime and by . The internet-based learning process, or commonly referred to as online learning, is increasingly widespread, especially to access various learning resources that are widely available on the internet. This has encouraged the implementation of *self-paced learning* method, which allows students to access various learning resources and conduct various learning activities according to their own control and learning speed.

Figure 7 shows a *blended learning* method involving *self-paced learning*. Within a learning period (e.g. 1 semester), tutorial sessions can be conducted either online or face-to-face by a tutor. In the tutorial session,

Students are encouraged to learn freely from various learning resources and undertake various activities in *self-paced learning* sessions. *Drop-in* sessions can be provided, either online or face-to-face as well, if students require special interaction with tutors or lecturers at their request. Whether during tutorial sessions, *self-paced learning* or *drop-in* sessions, students can still interact with lecturers, tutors or fellow students through online forums, which are available in a *learning management system*.

A blended learning method that implements *self-paced learning*

One example of the implementation of online-based self-paced *learning* is the *Massive Open Online Courses* (MOOCs) programme. This programme offers a variety of free online courses that can be attended by . MOOCs provide learning programmes, which are affordable and flexible, that can be followed by students to learn new skills or improve their careers, and provide quality learning experiences on a *massive* scale. The learning process in MOOCs provides flexibility in setting the pace of learning and high flexibility of learning time for students. In this case, learning materials are available in various media, usually in form of videos, which can be accessed online by students for free. Coursera, Khan Academy and edX are examples of MOOCs providers that are in high demand.

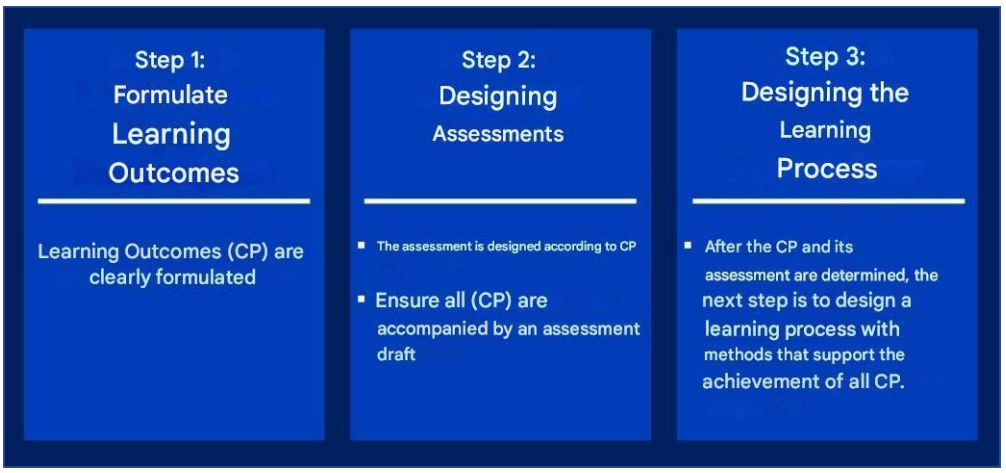
V. LEARNING METHOD SELECTION STRATEGY

A good curriculum supported by adequate facilities and infrastructure will not work as expected if lecturers do not choose and apply appropriate learning methods. These reasons indicate that learning methods are a necessary condition for the successful achievement of learning outcomes. This implies the responsibility of lecturers to master the strategy of selecting learning methods and applying them consistently. There are many choices of student-centred learning methods, group discussion, role play, case-based learning, project-based learning, and others as described in Chapter III.

In general, learning methods can be interpreted as a way to achieve learning outcomes or learning objectives. Therefore, the selection of learning methods should be based primarily on the type of learning objectives (Bonner, 1999). In line with that, according to Biggs (Biggs, 1996), the selection and application of learning methods should be orientated to achieve learning outcomes. In addition to the suitability of learning methods with learning outcomes (CPs), according to Shailaja (2017) and Taylor et al. (2013), factors such as the characteristics of teaching materials, student characteristics, availability of resources, and learning environment should also be considered.

A Alignment with Learning Outcomes (CP)

According to Biggs (1996), the learning process should facilitate students to achieve CP. Therefore, constructive alignment between learning methods and CPs needs to be built to achieve CPs. Besides the alignment between CPs and learning methods reflected in the learning process, Biggs also advocates the alignment between CPs, learning methods or processes, and assessment. Figure 8 shows the operational framework of Biggs' constructive alignment model (Alfauzan & Tarchouna, 2017).



Operational framework of Biggs' constructive alignment model (Alfauzan & Tarchouna, 2017)

Biggs identified a tendency for students to only learn about what will be tested, as a result, assessment will be their orientation in learning. So instead of the curriculum being the guide, it is the assessment that is the focus of orientation. This is not a problem, if the assessment is in accordance with the curriculum, or if the assessment is aligned with the CP that has been formulated. Therefore, the alignment between CPs, assessments, and learning methods needs to be considered, so that students will learn what they need to learn to achieve CPs. One way to check for such alignment is to create a mapping table as shown in Table 2.

Table 2 Alignment mapping between CP, assessment, and methods

CP	Form of Assessment	Learning Process	
		Learning Activities	Methods Learning
Attitude			
Knowledge			
Skills			

B Characteristics of teaching materials

Teaching materials are closely related to CP, therefore the alignment of learning methods with CP also implies the need for alignment of these methods with teaching materials. Teaching materials consist of facts, concepts, principles, and procedures. The teaching material characteristics of each course are different,

even between topics in the same course can be different. In addition, the level of difficulty or complexity also varies. This diversity affects the success of the learning methods applied. There are teaching materials that can be taught well with several choices of learning methods, but there are also teaching materials that have suitability for only certain methods. For example, the topic of measurement in physics or science learning is suitable if taught with methods that involve laboratory or practicum activities, so that in addition to understanding the concept of measurement, students are also skilled in using measuring instruments. Therefore, lecturers are required to have the ability to choose and apply learning methods that are most suitable for the teaching material.

C Student Characteristics

Student-centred learning puts learning activities at the centre of attention. Students have the opportunity to control their own learning through active involvement in the learning process. In student-centred learning, the responsibility for learning has shifted to students (Wright, 2011). In fact, the characteristics of students are diverse, including gender, age, socio-economic background, learning experience, and psychological development. The diversity of student conditions must be considered in the selection of learning methods and the management of their implementation. This needs to be done so that learning can take place as planned, all students are actively involved, and learning does not tend to be dominated by certain students.

D Resource Availability

Resources that support the learning process include space or buildings, classrooms, laboratories, and libraries; IT facilities; assistants, labouratories, technicians, and librarians. Adequate availability of these resources will support the successful implementation of student-centred learning methods. Conversely, limited resources will clearly become an obstacle to learning. For example, limited tools and materials and the absence of laboratory staff are often the reasons for lecturers not to carry out laboratory activities.

E Learning Environment

Learning success is related to the environment in which learning activities are organised. For example, compared to learning activities in the classroom, activities in the laboratory are less formal, students are free to observe, do, and interact individually or in groups. Therefore, the selection and application of learning methods must pay attention to the situation and conditions of the existing learning environment. Or vice versa, if a lecturer will apply a learning method, then he must create a conducive learning environment that supports the method. This conducive learning environment will increase interaction between students and students, students and lecturers, as well as between students and learning resources, both offline and online. Therefore, related to the learning environment and method selection, the number of students in a class or group must also be considered so that the interaction in student-centred learning can be well maintained.

VI. CLOSING

Student-centred learning is one of the learning approaches mentioned in Permendikbud No. 3 of 2020 concerning National Higher Education Standards (SN-Dikti). The approach states that the Graduate Learning Outcomes (SLOs) are achieved through a learning process that prioritises the development of students' creativity, capacity, personality, and needs, as well as developing independence in seeking and discovering knowledge. Various methods included in student-centred learning, such as *Case Based Learning, Collaborative Learning, Cooperative Learning, Project Based Learning, Problem Based Learning,* and others, support the achievement of students' abilities in *high order thinking* such as complex problem solving skills, critical thinking, creative thinking, communication, collaboration, and empathy. These SCL methods encourage students to play an active role in the learning process. Especially for the last two SCL methods, namely *Project Based Learning* and *Case Based Learning*, it is also an SCL method that is encouraged to be implemented in the form of Merdeka Belajar-Kampus Merdeka learning activities. Technological developments, especially the use of ICT in the learning process, also colour the various variations of SCL methods that can be applied in a mix. The application of SCL by utilising ICT is also in line with the industrial era 4.0.

The selection of various SCL learning methods depends on the characteristics of the learning material, curriculum, learning resources, learning environment, as well as the conditions of lecturers and students. On the other hand, various technological developments and changes in the demands of the world of work have encouraged lecturers to continue to develop themselves in order to conduct appropriate SCL learning. The application of appropriate SCL methods is expected to support the improvement of learning quality and learning effectiveness for students in fulfilling course learning outcomes. This guidebook is arranged systematically and structured so that it is expected to be one of the guides for lecturers in understanding various SCL learning methods including forms of evaluation and the use of ICT needed in designing the learning process of the courses taught.

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Lecturers have the duty of Tri Dharma Perguruan Tinggi, namely education, research, and community service. The demands of research performance and publications often override the improvement of educational performance. Years of teaching experience often do not follow efforts to improve the quality of learning in the courses taught. Teaching education and training for most lecturers does not provide sufficient provision to continuously evaluate and improve the performance of the learning process. The demands of the National Higher Education Standards on the quality of the learning process, including the characteristics of the learning process, the planning of the learning process, the implementation of the learning process, and the student learning load, need to be fulfilled so that students get the best academic services.

Changes in the education paradigm occur due to the demands of the development of science, technology and art as well as the demands of graduate competencies in the industrial era 4.0. The ability to collaborate, think critically, think creatively, communicate, and empathise in solving increasingly complex problems needs to be trained through well-planned and measurable learning experiences. Students are required to be more active and involved in the learning process so that the learning orientation is centred on how students can meet the expected learning outcomes.

This book provides an alternative for lecturers to choose learning methods that are in accordance with the desired capabilities...,

characteristics of learning materials, characteristics of students, availability of resources, and learning environment. Availability learning resources in various modes and lecturer interaction and students with multiple platforms are also encouraged to students can learn independently by planning and responsible for the learning process chosen to achieve learning goals.