

## Research Article

# Graduate Study with Online Education in the Post-Pandemic Era: An Experiential Case Study

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## Abstract.

It is important for the human resources industry to have the ability to overcome existing industrial challenges as well as to prepare for the coming challenges impacted by the changing strategic environment. This includes but is not limited to Industry 4.0, VUCA & BANI World, the COVID-19 pandemic, Society 5.0 and changing geopolitics. To be able to deal with more complex problems requires Higher-Order Thinking Skills (HOTS). Therefore, improving HOTS, especially in the human resources industry, requires a solid partnership between industry and academia. The academic partnership will be meaningful in improving HOTS's ability through a tailored master's program known as a multi-disciplinary master's program (MDMP). MDMP improve the HOTS of industry human resources by combining the strengths of academics and industry. This is an action research developed together between industry and academia and performed in several academic projects towards a master's degree in various fields. It was concluded, based on the results, that MDMP showed promising results toward the improvement of industry human resources, especially in the ability of HOTS.

**Keywords:** higher-order thinking skills, academic-industry partnership, multi-disciplinary master's program

## 1. Introduction

It is undeniable that competitiveness has become, among others, one of important factors for industries to be able to compete and survive due to the change of strategic environment especially related to Industry 4.0, VUCA, BANI, and Society 5.0. Therefore, industries must strive to improve their competitiveness in various fields including but not limited to human resource development. Development of human resources in industry is simply aimed at improving both technical and cognitive abilities. In an effort to improve technical competence, generally industries have created a department, or division, or directorate, or else like corporate university (Corpu) within the company to carry out training from the internal or external sources. The reason for industries to improve

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their human resources by teaching and learning among others are business pressure, complexity of problems, competition, change in strategic environment, etc. Therefore, human resources in industries require the ability of Higher-Order Thinking Skills (HOTS) [1]. Normally, the effective approach to improve teaching and learning is by using and adopting correct pedagogical approach. That is why the academic cooperation between industries and Higher Education Institutions (HEIs) become an important factor in developing human resources. The needs to improve HOTS for students actually has been addressed by scholar for the reason to prepare student to be ready in their new role as professional [2, 3]. Considering the gap of HOTS ability in existing human resources in industry therefore this paper present an experiential case study related to academic cooperation in degree programs to fill the gap.

## 2. Method

This paper uses an action research method that has been carried out in projects for several years with industrial partners as case studies. The concept of the project known as the Multi-Disciplinary Master's Program (MDMP). It was a master degree program designed specifically to combine strengths of academic and professional.

## 3. Literature Review

### 3.1. Learning pedagogy

Pedagogy is simply a method to perform teaching and learning process using various strategies and approaches to achieve learning objectives. The pedagogical approaches are 1. constructivist, 2. collaborative, 3. integrative, 4. reflective, and 4. inquiry-based (see Table 3). In pedagogical point of view, development of human resources at least to be focused on three important abilities namely cognitive, affective, and psychomotor (see Table 4.). Instead of three factors of abilities, Ki Hadjar Dewantara, an Indonesian education guru, on the other hand had defined five factors of abilities (it is familiar as "Panca Daya") to develop human resources namely 1. Piety, 2. Creativity (Cognitive), 3. Feeling (Affective), 4. Craftsmanship (Psychomotor), and 5. Willpower (Conative). Therefore, it is become a challenge for industries in an effort to improve human resources especially at least on the competence domain of cognitive, affective, and psychomotor abilities. In practical way, the effective and efficient to do so is by involving higher education institution (HEI) in the development process of human resources development especially

in cognitive domain that consist of Low-Order Thinking Skills (LOTS) and Higher-Order Thinking Skills (HOTS). The reason is that by nature the work and competence of HEI is in pedagogic of teaching and learning which is transfer of knowledge and transfer of value. HEIs used to deal with teaching and learning including but not limited to LOTS and HOTS. LOTS and HOTS is a part of Bloom’s Taxonomy that recognizes skills from the lowest level to the highest level (Table 4.). Figure 1. shows that level C1 to C3 is categorized as LOTS while level C4 to C6 is categorized as HOTS. LOTS is ability to think functionally which is the ability to memorize and focus on the power of mind memory. While HOTS is strategic thinking skills that use information to solve problems, analyze arguments, negotiate issues, or make predictions. Therefore, HOTS thinking skills no longer rely on thinking based on memory abilities as in LOTS, but thinking based on what to look for and to find so that understanding of the problem really comes from the root of the problem. According to Resnick [4] HOTS is a process to describe material, make conclusions, build representations, analyze, as well as build relationships. Learning skill of HOTS include three important aspects i.e. 1. Critical, creative thinking, 2. Transfer of knowledge, and 3. Problem solving (Figure 1). Therefore, the competence of HOTS such as critical thinking, creative thinking, innovative thinking, communication, collaboration, computational logic, compassion, and civic responsibility are actually very important thinking skills for professionals

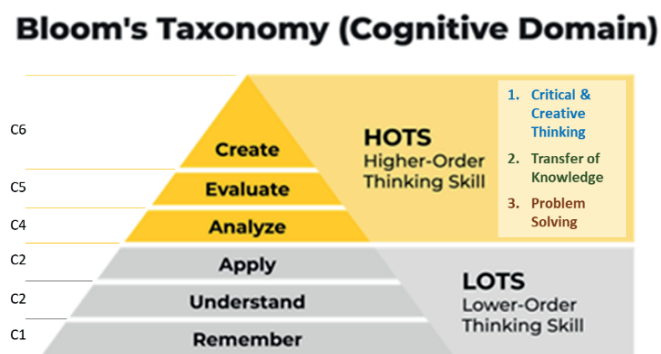


Figure 1: Bloom’s Taxonomy.

Furthermore, Anderson, L. W. & Krathwohl, D.R., et al [5] improved the Bloom’s Taxonomy by adding new dimension of knowledge that consist of four level of knowledge i.e. 1. Factual, 2. Conceptual, 3. Procedural and 4. Metacognitive.

1. “Factual Knowledge” related to basic knowledge for a particular discipline. Factual knowledge refers to facts, terminology, details, or important things that learners must know to understand a specific discipline in order to solve a problem.

2. “Conceptual Knowledge” related to knowledge in a particular discipline about classifications, theories, models, generalizations, principles.
3. “Procedural Knowledge” related to knowledge that can assists learners to do a specific thing in a discipline, or study field. It can be referred to methods of inquiry, techniques, and methodologies.
4. “Metacognitive Knowledge” related to certain cognitive processes. It is actually strategic knowledge of solving problems by using conditional, contextual, and self-knowledge.

The forms of knowledge generally will change from real to abstract related to the level of education. The relationship of knowledge dimensions and cognitive processes dimensions shown in table 1.

TABLE 1: Combination of the dimensions of knowledge and cognitive.

		COGNITIVE DIMENSION					
		C1 Remembering	C2 Understanding	C3 Applying	C4 Analyzing	C5 Evaluating	C6 Creating
KNOWLEDGE DIMENSION	Factual	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="background-color: yellow; padding: 10px; border: 1px solid black;">LOTS</div> <div style="background-color: green; padding: 10px; border: 1px solid black;">HOTS</div> </div>					
	Conceptual						
	Procedural						
	Metacognitive						

### 3.2. Higher Order Thinking Skills (HOTS)

Considering the complexity of problems nowadays, it is necessary that the way to perceive understanding must be done in comprehensive, multidimensional and interactive instead of linear, unidimensional, or hierarchical. The increasing complexity of real problems nowadays require a complete skills of sound of reasoning, analytical, problem solving, as well as critical and creative thinking. Actually intelligence is something that be changed by various factors such as learning environment, strategies, and awareness in learning. Therefore, Higher-Order Thinking Skills (HOTS) that can be acquired by teaching and learning is now become the important factor in developing human resources in industries, professional, and academic. Effective learning concept of HOTS has been proposed by several authors including Fogarty [6] that proposed the so-called the Four-Corner framework i.e. 1. Teaching for Thinking, 2. Teaching of Thinking, 3. Teaching with Thinking, and 4. Teaching about Thinking (Table 2).

TABLE 2: Effective learning concept of HOTS.

No.	The Four Dimension	Meaning
1	Teaching for Thinking	Conditioning the class atmosphere
2	Teaching of Thinking	Learn skills of higher order thinking
3	Teaching with Thinking	HOT learning structured
4	Teaching about Thinking	Help learners to reflect Metacognitive

By nature, human resources in Industries is classified as “adult” who has different method of learning compared to teenager and or children. Consequently, the pedagogic approach for adult should be correctly defined. There are five pedagogical approaches summarized in table 3. below.

TABLE 3: Types of Pedagogical Approaches.

Constructivist	Collaborative	Integrative	Reflective	Inquiry-based
Builds on past knowledge Student-centered Learning by doing	Involves teamwork Teachers and students may/may not work in teams Using different teaching practices with different groups	Integrates the class room with the outside world Makes the curriculum more realistic and relatable Encourages application of acquired knowledge	Continuous assessment of pedagogical practices Model-approach for the trainee- teachers Outcome-based Involves in-time reassessment of the objectives	Student-centered Excites curiosity in the learners Enhances problem -solving skills Four Types: Confirmation Structure Guided Open

Furthermore, it is important in learning design to understand the level of knowledge in cognitive, affective, and psychomotor domain that will contribute to degree of knowledge transfer (See Table 4.).

TABLE 4: Competence Domain.

Level Highest to Lowest	Cognitive Domain (Anderson & Kratwohl, 2001) [7]			Affective Domain (Kratwohl, Bloom & Masia, 1964) [8]		Psychomotor Domain (Dave, 1975) [9]	
	HOTS	C6	Creating				
		C5	Evaluating	A5	Characterizing	P5	Naturalization
		C4	Analyzing	A4	Organizing & Conceptualizing	P4	Articulation
	LOTS	C3	Applying	A3	Valuing	P3	Precision
		C2	Understanding	A2	Responding	P2	Manipulation
		C1	Remembering	A1	Receiving	P1	Imitation

### 3.3. Indonesian Qualification Framework (IQF)

According to Directorate General of Higher Education (DGHE) of the Republic of Indonesia, Indonesian Qualification Framework (IQF) is a qualification framework for Indonesian human resources that equalizes, and integrates the education sector with the training and work experience sectors in a work capability recognition scheme that is adapted to the structure in various

The IQF consists of nine levels of qualifications for productive Indonesian human resources (see Figure ??). The description of qualifications at each level of the IQF comprehensively considers a complete learning outcome, which can be produced by an educational process, whether formal, non-formal, informal, or independent experience to be able to do quality work. The description for each level of qualification is also adjusted to developments in science, technology or art, as well as developments in sectors supporting the economy and people’s welfare, such as industry, agriculture, health, law and other related aspects. Learning outcomes also cover aspects of building national identity as reflected in Pancasila, Indonesian Constitution of 1945, and Unity in Diversity (Bhinneka Tunggal Ika) namely upholding the five principles of Pancasila and law enforcement, and having a commitment to respecting diversity of religions, ethnicities, cultures, languages, and art that grows and develops in Indonesia.

IQF is a breakthrough towards recognition of human resources qualification. Therefore, there will be no more wall of barrier for the recognition of qualification at the same level of IQF. The relation between university graduate and job market as shown Table 5.

TABLE 5: Linking University Graduate Qualification and Job Market.

<b>IQF Qualification Level</b>	<b>Keywords workability in IQF</b>	<b>Program equality</b>
9	Conducting deepening and expansion of new science and technology by research, problem solving in a multi (or trans) disciplinary approach.	Doctor
8	Developing science and technology by research, innovation and testing, problems solving by inter/multi-disciplinary approach	Master
7	Managing resource as well as comprehensive evaluation for organization strategic development, problems solving with a mono-discipline approach	Profession
6	Applying, reviewing, designing, utilizing science and technology in solving procedural problems	Bachelor

This paper utilized the IQF in order to design education concept for especially academic cooperation program with Industries. The reason is that student from industries

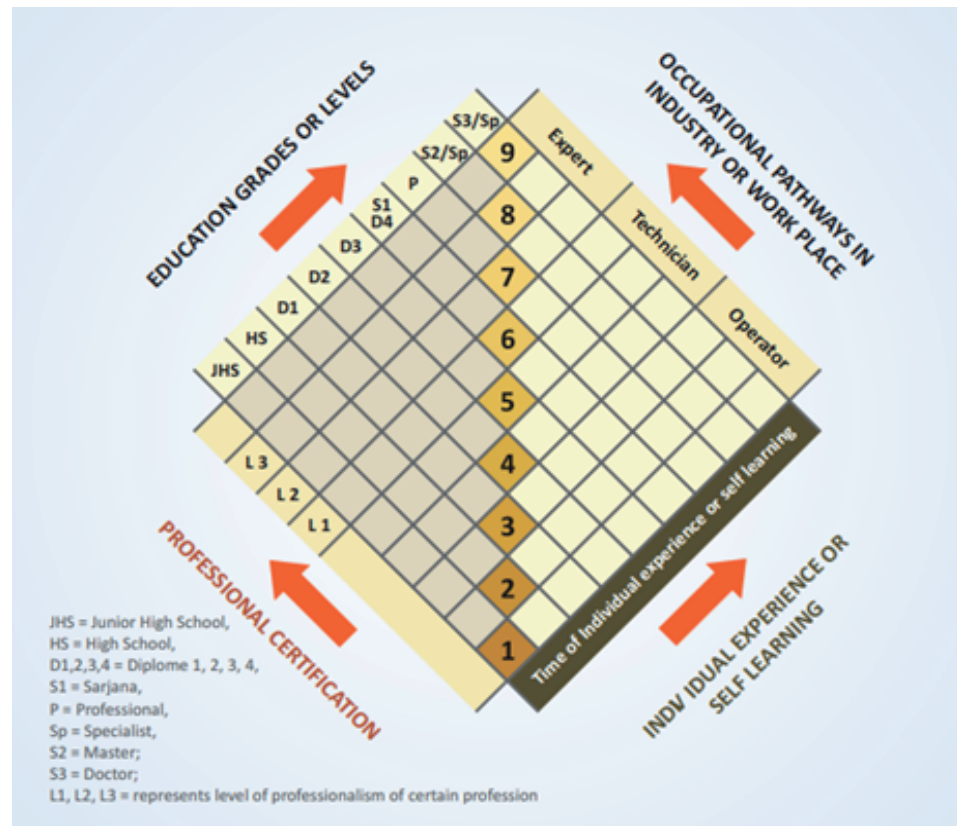


Figure 2: IQF Level through Different Pathways.

actually already have such qualification from non-formal, informal, and job experiences. Logically, according to the IQF, even though it may not be easy, it is possible that the prior learning experience can be accepted and recognized in a formal education system especially the applied science. It is actually recognition of prior learning (RPL) concept. According to the Minister of Research, Technology, and Higher Education Republic of Indonesia No. 41/2021 Recognition of Prior Learning (RPL) is an acknowledgment of achievement one's learning gained from formal, non-formal, informal, and/or education work experience as a basis for continuing formal education and to do equality with certain qualifications.

### 3.4. Changes in strategic environment

There are several changes in strategic environment that this paper will discuss related to academic implication among others are Industry 4.0, Pandemic of Covid 19, BANI World, and Society 5.0.

### 3.4.1. Industry 4.0

Baskoro [10] described that Industry 4.0, has been driven by nine advanced technologies such as 1. Big data and analytics, 2. Autonomous robots, 3. Simulation, 4. Horizontal and vertical integration, 5. Industrial Internet of Thing (IoT), 6. Cyber security, 7. The Cloud, 8. Additive manufacturing, and 9. Augmented reality. In addition to that Artificial Intelligence (AI) and rapid development of IT technology have impacted directly or indirectly to industries as well as higher education. In education, we have experienced that distance/online learning method become new normal in education system. Actually distance/online learning practiced has been done for some years which allowed people to study in distance. In distance and or online learning that has been influenced by Industry 4.0, (higher) education will be different than before in terms of a) education delivering method, and b) relevance of the courses [9, 11-13].

### 3.4.2. Pandemic of Covid 19

Not surprisingly, Covid 19 has changed the way people live, work, study, etc. Initially no one so sure when the pandemic will last and it creates an uncertainty. The situation today is different, pandemic no longer become uncertain situation as people can live with it. Initially pandemic is a typical “non-inventive” problem, but today it is already an “inventive” problem. Non-inventive problem is a problem that no one has experienced before, so that no one so sure how to fix it. On the uncertain situation like this, the impact may be unpredictable for example in business, people interaction, and also in education. In the new normal situation today, “online” has become part of people life including in education [14]. Online education covers online learning, online teaching, and whatever online as long as not meeting face-to-face.

### 3.4.3. BANI world

In the past VUCA world an acronym of Volatility, Unpredictability, Complexity, and Ambiguity become our concern especially the way we see strategic environment. Today, especially after the Pandemic of Covid 19 VUCA World may not be relevant anymore to represent the strategic environment. Today strategic environment has been introduced by Jamais Cascio as the BANI World, an acronym of Brittle, Anxiety, Non-Linearity and Incomprehensible. Therefore, the strategic environment of BANI will be our concern in any strategies, plan, consideration, etc. including but not limited to education.



### 3.4.4. Society 5.0

Society 5.0 was identified as one of the strategies of growth for Japan. It was presented as a core concept in the 5th Science and Technology Basic Plan, adopted by the Japanese Cabinet in January 2016 [15]. The idea of society 5.0 related to the industry revolution 4.0 in which the forefront digital technologies such as 1. Big data & analytic, 2. Autonomous Robots, 3. Simulation, 4. Vertical Horizontal Integration, 5. IIOT, 6. Cyber Security, 7. Clouding, 8. Additive Manufacturing, 9. Augmented Reality (AR), etc. are widely adopted by industries and communities that will (revolutionary) change society. Society development has been categorized by Keidanren at least into several phases namely Society 1.0, Society 2.0, Society 3.0, Society 4.0, and Society 5.0.

Society 5.0 is a term to indicate society after hunting society, agricultural society, industrial society, and information society. It is the vision of future society in Japan and of course applicable elsewhere due to rapid and broadly adoption and adaptation of digital technologies especially related closely to Industry 4.0. It is actually a human centered society that well combine physical and cyberspace. Simply, it is a digital society that connect closely digital based technologies and human in most of life activities [16].

## 4. Case Study

Several case studies have been performed during and after the pandemic of Covid 19. The case studies cover academic degree programs toward bachelor (undergraduate study) and master (graduate study) in the field of engineering, technology and management. However, this paper will discuss the graduate study programs only.

### 4.1. Design of MDMP graduate study program

The concept of graduate study program under academic cooperation between HEI and Industry is the so-called Multi-disciplinary master's program (MDMP) [10]. MDMP was designed to combine professional and academic strengths. MDMP maximized and optimized the aspects of 1. Thinking, 2. The higher order thinking skills (HOTS), 3. The combine strengths of professional and academic, 4. The balance of right and left brain, 5. The combine professional and academic courses, and 6) The real life case study. It was designed to ensure that graduates have competences to be "T" shaped people [14]. "T" shaped people is simply a people who has competence in HOTS i.e. having skills

of critical thinking, creative thinking, innovative thinking, communication, collaboration, computational logic, compassion, and civic responsibility.

As the students of MDMP graduate study programs were professionals who have long standing professional experiences in the field therefore the teaching and learning of MDMP tailored towards adult teaching & learning method. The concept of MDMP academic design is to ensure the curriculum fulfilling the needs and wants of industry while at the same time fulfilling the academic requirements towards master study that meet Indonesia constitution No. 12 year 2012 regarding higher education as well as regulation of Indonesia Minister of Research Technology and Higher Education no. 44 year 2015 regarding National Standard of Higher Education [17], in article 9 the Master program in higher education institution is designed with the objective of:

*“Graduates from the master, applied master, and specialist one programs at least master the theory and application theory of a particular field of knowledge”*

Therefore, the MDMP was designed to meet the objectives of 1. Applying the knowledge through scientific reasoning and scientific research, 2. Becoming scientist, entrepreneur and or professional.

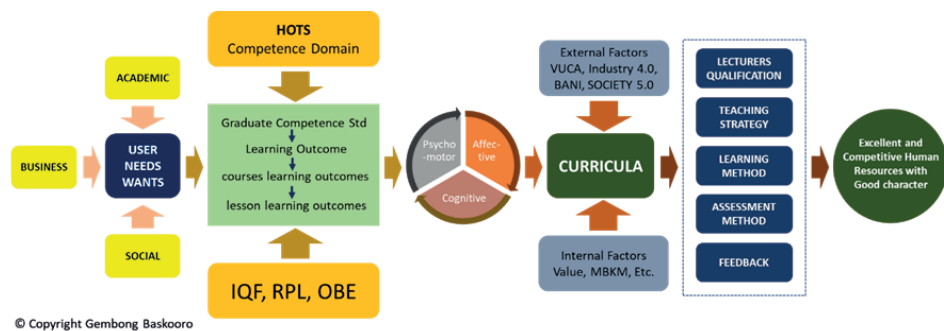
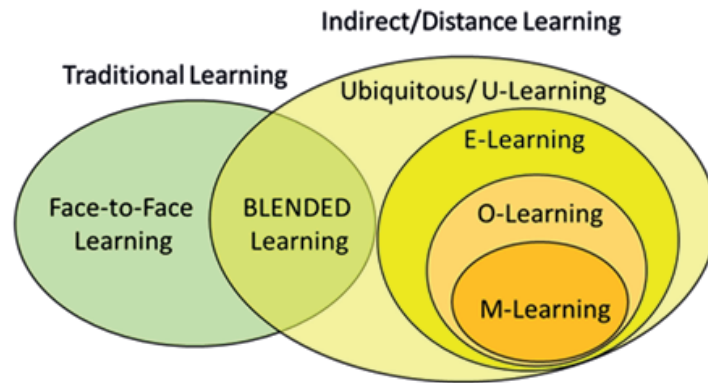


Figure 3: Concept design of MDMP©.

The concept of MDMP as shown in Figure 2. is actually transformation from user needs and wants into academic outcomes that influenced by requirements of competence domain i.e. HOTS as well as Indonesian academic approach and standards such as IQF, RPL, and Outcome Based Education (OBE). All of this factors will determine the three important competence domains to be achieved i.e. Cognitive, Psychomotor, and Affective. HOTS is actually competence domain located as in table 1. Once the competence domain has been defined, the curricula can be developed based on various input of external and internal factors. Curricula is actually an academic plan; therefore, a good academic plan will result in good result if the quality of implementation is also good. To ensure good implementation of curricula therefore several teaching and learning factors must be well prepared.

## 4.2. Method of teaching & learning

Baskoro [18] indicated in Figure 3 several available methods of teaching and learning i.e. 1. Face-to-Face learning, 2. Indirect/Distance learning, and 3. Blended Learning. During the case study all three methods of teaching and learning have been applied.



**Figure 4:** Learning methods.

### 4.2.1. Traditional Face-to-Face Learning

This is a traditional form of learning in which learning is carried out face-to-face directly in real time between lecturers and students/learners. Face-to-face learning has the advantage of engagement and direct interaction so that the sensation of learning atmosphere can be felt especially in the discussion session. Face-to-face learning can also improve bonding between lecturer with learners, and among learners themselves. The disadvantage of face-to-face learning perhaps on the flexibility especially in term of (geographical) distance [18].

### 4.2.2. Indirect/Distance Learning

Indirect/distance learning is a process of learning carried out in a (geographical) distance and study time as the main obstacles. Therefore, technology is needed to overcome obstacles due to distance and time. Indirect/distance learning is actually a solution from the weakness of face-to-face learning regarding (geographical) distance and time. Consequently, technology plays a major and central role in flexible/indirect/distance learning. Until now, U-learning methods that includes E-learning, O-learning, and M-learning, are familiar especially during the pandemic of Covid 19. Ubiquitous learning (U-learning) is a new education paradigm aimed at supporting ease of learning from

everywhere, anywhere, anytime and in any way. It seems that U-learning can be an ideal learning model, especially because of the availability of digital technologies that can support the implementation of this learning process. Figure 3 illustrates that U-learning consists of E-learning, O-learning, and M-learning. The differences among them is due to technology being used. There are two activities in distance learning, namely synchronous and asynchronous. In synchronous learning the time is scheduled with real time learning therefore students and lecturers attend at the same time. While in asynchronous learning, time is not specified and learning content mostly is already provided online so that students can learn any time they like. Simply asynchronous learning is a student centered learning method [18].

### 4.2.3. Blended Learning

Simply to say, blended learning is a learning method that combines face-to-face or direct learning with flexible/indirect/distance learning. Therefore, in blended learning the strengths of both direct and indirect learning are combined in order to face the challenge of (geographical) distance and study time while keep maintaining its effectiveness and efficiency [18].

### 4.3. Pedagogic

Initially the basic pedagogy that has been applied in MDMP case study was the andragogy as adult learning concept, however it was changed due to the change of strategic environment towards heutagogy, peeragogy, and cybergogy.

1. "**Pedagogy**" (Child learning) requires significant guidance in learning process. It is teacher led learning.
2. "**Andragogy**" (Self-directed Adults learning) is a method of learning that encourages learners to be independent/self-directed learning process to solve problems. The learning process is influenced by backgrounds, prior knowledge and experience. Therefore, the purpose of learning is for competency development.
3. "**Heutagogy**" (Self-determined learning) is a learning method that enables learners to do self-directed learning and can able to pursue soft skills needed in today's digital era. In today digital era, the abundance information can be sourced from any digital platform. Therefore, in heutagogy, students who want to learn is driven

by desire in achieving goals. The learning purpose is actually to improve capability from any possible digital sources available today. This learning method is considered very suitable in the digital era today due to the change of strategic environment i.e. Industry 4.0, Covid 19, BANI, and Society 5.0.

4. **"Peeragogy"** (Co-learning & Co-Creating) is a learning methods that focuses on co-learning and co-creating using case/problem/project based learning.
5. **"Cybergogy"** (Learning in Online Environment) is a cyber-physical education service system, which is a form of service in the current digital era.

## 5. Assessment and Discussion

Assessment on a case study, MDMP in Engineering (management), is carried out subjectively by the author. This is possible because it is an experiential case where the author has involved in the program from the initiation up to finalization of the program.

It is shown from table 6. that MDMP in this case specifically in Engineering (Management) has been designed with full consideration of factors that impact to the quality of education. It is shown from table 6. That the objective of improving the HOTS has subjectively fulfilled with promising result (++++). It is also shown in table 6. that several factors of MDMP indicated in good results (++++) but some others still require improvement (++, +++). It is shown in table 6. that some competence domains i.e. affective and psychomotor have resulted in very low assessment (+). The reason of low assessment due to the fact that curricula for master program is specifically design for cognitive competence domain instead of affective and psychomotor. While in learning method F-to-F learning and M-learning have also resulted in very low assessment (+). The reason is that the MDMP program was carried out during the pandemic of Covid-19, consequently the learning method applied was fully e-learning and or online-learning.

## 6. Conclusion

It is concluded that MDMP is a good initiative from industry and academia to improve the ability of HOTS for human resources in industry especially in cognitive competence domain as the main objective of industry-academic partnership. Due to the pandemic of Covid 19, the MDMP was done using online-education and or online learning and seemingly the quality of learning still need to be justified. Online-learning has drawbacks in "personal touch and feeling" if it is compared to face-to-face learning. Therefore, the

TABLE 6: The Summary of Subjective Assessment Result of MDMP in Engineering (Management).

Factors of Quality in Education	MDMP in Engineering (Management)	Note
<b>Curriculum</b>	++++	MDMP, IQF, OBE, MBKM, and RPL
<b>Lecturers Qualification</b>	++++	Highly academic standing with long professional experience
<b>Teaching Strategy</b>		
Andragogy	++++	Self-directed
Heutagogy	++++	Self-determined using any digital source
Peeragogy	++++	Co-learning with case, problem, and project based assignment
Cybergogy	+++	Using E-learning and O-Learning
<b>Learning Method</b>		Using both synchronous and asynchronous
F-to-F Learning	+	
Blended Learning	+++	
U-Learning	++	
E-Learning	+++	
O-Learning	++++	
M-Learning	+	
<b>Teaching Method</b>		
Team Teaching	++	Rotational team teaching only
Active Learning	++	Vertical & horizontal communication
<b>Assessment Method</b>		
HOTS	++++	Conceptual and Metacognitive knowledge with C4-C6 cognitive dimension
Affective	+	
Cognitive	++++	
Psychomotor	+	
<b>Feed Back</b>	++++	Online feedback

Note:

+ = Very little Implemented, ++ = Partially Implemented, +++ = Largely Implemented, +++++ = Fully Implemented.

best idea is to apply blended-learning that combine and incorporate the strengths of online and face-to-face learning. It is suggested to conduct ubiquitous learning (U-learning) especially Mobile-learning (m-learning) with cybergogy especially for new digital generation and due to the rapid development of digital social media and infrastructure. Finally, to accommodate the expertise of human resource in industry as well as

in term of effectiveness, therefore Recognition Prior Learning (RPL) will be an advantage to be accommodated in some specific courses for MDMP in the future.

In term of academic, this experiential case study of MDMP as a result of academic partnership between academia and industry has given a promising result of delivering new academic approach towards master degree specifically for human resources in industry.

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