A Conceptual Framework to Design and Develop Project Based Learning Instruments and Rubrics for Students with Autism in Learning English Language

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***Abstract* – The purpose of this study is to design and develop Project Based Learning: Instruments and Rubrics for Autism (PBL-iRA) as a set of tools that can be used in primary schools to enhance the learning experiences of students with Autism Spectrum Disorder (ASD). As there is no guideline in assessing and evaluating students with Autism' s performance in learning English language, it is a necessity to consider having an outline or module of instruments and rubrics which implement the instructional approach of project based learning. Thus, this study emphasizes three theories that underpinning the development of the instrument and rubric which are the Vygotsky's Social Constructivist, Gardner's Multiple Intelligence and Dewey's Learning by Doing. This paper also presented the literature on the Design and Development Research (DDR), Nominal Group Technique (NGT) and Fuzzy Delphi Method (FDM) as these approaches were applied and implemented throughout this research as this study is DDR in nature. In line with the purpose of this study in designing and developing instruments and rubrics, analytic rubric is suggested to be proposed in this PBL-iRA.**

***Keywords* – Social Constructivist, Multiple Intelligence, Learning by Doing, Design and Development Research (DDR), Nominal Group Technique (NGT), Fuzzy Delphi Method (FDM).**

I. INTRODUCTION

The conceptual framework is a description of the general idea behind the entire research project that was carried out (Akker, et al., 2006). It is essential to the research because it clarifies how the genesis of an idea influences the research's design and execution (Padzil, et al., 2021). In this research, it shows that the basis of Project Based Learning (PBL) approach is built with so many significant theories that make it as a holistic approach to be introduced and implemented from early education. Significant theories that related to the idea of PBL are the theory of Social Constructivism by Vygotsky (1934), sustained with Constructivism by Bruner (1983), Multiple Intelligence by Gardner (1993), and Learning by Doing by John Dewey (1938). Therefore, PBL is an active student-centred form of instruction which is characterised by students' autonomy, constructive investigations, goal-setting, collaboration, communication and reflection within real world practices.

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II. BACKGROUND

Special Education consists of few categories of students. According to Education (Special Education) Regulations (2013), it has specifically defined that Special Education students are students who is certified by medical practitioners as having disabilities in the areas of visual, hearing, speech, physical, learning difficulties or any combination of the disabilities. By year 2021, 76 832 children with disabilities have been enrolled in Malaysian schools (Malaysia Educational Statistics, 2021). Commonly, Autism is categorized under the learning difficulties/ disabilities. Low et al. (2018) claimed that almost 25% of students enrolled in Special Education programmes in Malaysian schools have Autism Spectrum Disorder (ASD).

Autism Spectrum Disorder (ASD), also known as 'Autism', is a developmental disorder that affects a child's development. It is usually detected before the age of three, around the age of 30 months (Badzis & Zaini, 2014; Paulraj et al., 2016). Boyle et al. (2011) stated that ASD diagnoses in early children now outnumber from those with Down's syndrome, cerebral palsy, hearing impairment, and visual impairment. Children with Autism suffer from neuropsychological or psychological deficits that affect their behaviour, communication and social interactions. The inability to communicate makes it difficult for children with Autism to interact with others thus hindering the process of social interaction with outsiders (Norfishah, 2015). Autism often presents difficulties with social interactions, verbal and non-verbal communication and repetitive behaviours (Autism Speaks, 2013; Happe & Frith, 2020; Hannan et al., 2020). As language and communication are key to establish social interaction in human life, an approach must be taken to help children with Autism be able to communicate verbally or non-verbally (Flippin et al., 2010).

Many students with Autism have difficulties in shifting their perspectives to judge what someone else might think, instead simply reporting what they themselves know (Baron-Cohen, 2000). They tend to think literally instead of thinking out of the box. This is one of the reasons why we should guide them through their educational development so that we can help them to achieve the objectives of learning. This is why authentic pedagogy important for students with Autism. Authentic pedagogy defined as instruction and assessment which promotes authentic students' achievement. Authentic students' achievement refers to intellectual accomplishments that are worthwhile, significant and meaningful. Bruner (1996) stated that authentic learning is a construction of knowledge that is active processing of

experience, defined as the consolidation and internalization of information and procedures by the students in a way that is both personally meaningful and conceptually coherent.

The concept of the authentic learning leads to the main idea of this research which is learning through Project Based. Project Based Learning (PBL) background always been referred to the idea of Kilpatrick (1918). He believed that using literacy in evocative contexts can provides means for building background knowledge and achieving personal growth. The projects should be based on interdisciplinary subjects like Science, Mathematics and Language. Hynek (2017) defined PBL as an educational model in which the students work on carefully well-defined projects as the principal means in acquiring the required knowledge prescribed by the learning curriculum or school educational plan. Hovey and Ferguson (2014) stated that the key aspects of PBL are learning by doing, investigating real life problems, collaboration and the end product. Ngereja and Andersen (2020) suggested that goal setting is an important process in the implementation of PBL. In order to ensure the efficiency of PBL, the goal should clearly define as students would focus to complete the task and eventually produce a good end product.

In concurrence with 21st century learning, established in Malaysian Education Blueprint (PPPM) 2013-2025, Project Based Learning (PBL) become an important and significant approach to improve students' learning in terms of students' autonomy, learning interest, collaboration skills, project planning and many other substantial skills. The incorporation of pedagogy into the teaching and learning that takes place within educational institutions is necessary to achieve the objective of producing the highest quality of human capital feasible in the 21st century learning (Tiantong & Siksen, 2013; Sandra et al., 2020).

III. LITERATURE REVIEW

Social Constructivist Perspective on Children Learning

Social Constructivism is a sociological theory of knowledge according to which human development is socially situated and knowledge is constructed through interaction with others. In this study, Social Constructivism provides the theoretical foundation for the conceptualization and interpretation of the evolving information resulting from the application of project based learning in this research.

The work of Lev Vygotsky (1934) is the foundation of Social Constructivism as a theoretical framework for children's learning development. Vygotsky's work is crucial since he emphasized the importance of 'social atmosphere/interaction'. Children, he believes, develop their knowledge through social interaction in their learning contexts, with all of the possibilities and constraints that this entails (Bas & Beyhan, 2010).

Bruner (1983) developed the constructivist learning theory. His learning paradigm, in which a child is viewed as an "active actor" in his or her own learning, retaining, selecting, and manipulating information to construct knowledge shaped by his or her own unique way of perceiving and interpreting the world. Bruner (1983) believed that a child's learning is a process, not a product, that may be hastened or enhanced by social and group interactions.

Project Based Learning (PBL) is an approach of instruction in the form of student-centred and the foundation is based on three constructivist principles: (1) learning takes place in a particular setting; (2) students participate actively in the educational process; and (3) students accomplish what they set out to do through collaborative efforts with their peers and the exchange of information and ideas. Al-Balushi and Al-Aamri (2014) specified that this approach is a type of inquiry-based learning in which the context of learning is provided by authentic questions and problems within real-world practises that lead to meaningful learning experiences (Wurdinger et al., 2007; Shaarani & Bakar, 2021).

Thus, in conjunction with constructivism theory, Blumenfeld et al. (2000) concluded that students require opportunities to construct knowledge by solving real-world problems by formulating and refining questions, designing and carrying out investigations, gathering, analysing, and interpreting information and data, drawing conclusions, reporting on findings and producing in an end product. The construction of an end product, a "concrete artefact," which represents students' new understandings, knowledge, and attitudes, is what distinguishes Project Based Learning (PBL) (Hargis, 2005; Helle et al., 2006).

Multiple Intelligences Theory in Learning Language

While everyone has eight intelligences, they are not all developed evenly in each person. Some teachers believe that they must design activities that incorporate all eight intelligences, not just to aid in language acquisition but also to assist students reach their full potential in all eight intelligences. One approach to achieve this is to consider the activities that are commonly utilised in the classroom and categorise them according to the types of intelligences (Larsen-Freeman, 2000).

Multiple intelligences are a branch of psychology concerned with how the mind processes data. Intelligence is defined as the ability to create something of worth or to find solutions to challenges. Students that take the time to learn about multiple intelligences and how they function can better take advantage of their individual strengths (Tiantong & Siksen, 2013). If we acknowledge that people have varied intelligences, then the same learning may not be acceptable for all of our students. While those with great logical/mathematical intelligence may respond well to a sophisticated grammatical explanation, students with strong visual/spatial intelligence may benefit from diagrams and tactile demonstrations. Other students with high interpersonal intelligence may demand a more engaging learning environment to be successful (Harmer, 2001).

The intelligence quotient (IQ), which tests a narrow range of verbal/linguistic and logical/mathematical abilities, has traditionally been used to characterise intelligence. Gardner (1993) claims that people have

several intelligences, each of which manifests itself in diverse skills and capacities. These intelligences are used by all humans to solve problems, invent methods, and create things. According to the many intelligences' theory, intelligence is the ability to apply one or more of the intelligences in ways that a community or culture nurtured values.

There are eight different teaching and learning styles under the notion of multiple intelligence.

i. Verbal/Linguistic Intelligence: The capability to effectively communicate verbally and in writing.

ii. Logical/Mathematical Intelligence: The capability to reason clearly and efficiently with numbers.

iii. Visual/Spatial Intelligence: The capability to comprehend form, space, colour, line, and shape, as well as represent visual and spatial ideas visually.

iv. Bodily/Kinaesthetic Intelligence: The capability to convey ideas and feelings through the body, as well as solve issues.

v. Musical Intelligence: The capability to recognize rhythm, pitch, and melody.

vi. Interpersonal Intelligence: The capability to recognise and respond effectively to the feelings, motivations, and intentions of others.

vii. Intrapersonal Intelligence: The capability to know and understand oneself, as well as recognise similarities and distinctions between oneself and others.

viii. Naturalist Intelligence: The capability to recognise and classify plants, minerals, and animals.

According to the list of the eight multiple intelligences, teachers can ensure they provide enough varieties in the activities they use so that as much of their pupils' learning potential can be discovered as possible (Bas & Beyhan, 2010). The younger the learners, the more physical activity they tend to need and the more they need to make use of all their senses (Brewster et al., 2003). On the basis of the theory of multiple intelligences, children can also draw a picture while listening to a description, act out a nursey rhyme, follow instructions or make a shape or simple model while they listen to a description of it. This draws on learning by the ear and eye and is good for those with bodily-kinaesthetic intelligence.

Bas and Beyhan (2010) discovered that there is a significant difference between the achievement levels of the students who have been educated by multiple intelligences supported Project Based Learning (PBL) method and the students who have been educated by the traditional language teaching methods in their study. The students who have been educated by multiple intelligences supported PBL method have become more successful than the students who have been educated by the traditional language teaching methods. Significantly, this PBL method helps the students to develop many skills like physical, intellectual, social, emotional and moral skills which are the skills that every young learner should develop. As a result, PBL methods is a process where students used different types of intelligence. Students created projects integrating eight types of intelligences of multiple intelligences theory. By this way, students not only had high achievement levels in English lesson, but also, they had a chance to practise their different skills such as drawing, writing, thinking, and others, and as well as using their difference intelligence types like spatial, musical, verbal, social intelligence and so on.

Learning by Doing Method in Education

The benefits of learning by practice have long been identified. The root of the idea is basically found by John Dewey (1859 – 1952). For over 100 years, educators such as John Dewey have reported on the benefits of experiential, hands-on, and student-directed learning. Most teachers knowing the value of engaging, challenging projects for students, have planned field trips, laboratory investigation and interdisciplinary activities that enrich and extend the curriculum (Bas & Beyhan, 2010). 'Doing projects' is a long-standing tradition in education (Markham et al. 2003).

Project based learning (PBL) is an instructional method of student centred. Instead of using a rigid lesson plan that directs a learner down a specific path of learning outcomes or objectives, PBL allows in depth investigation of a topic worth learning more about (Harris & Katz, 2001). PBL is a comprehensive approach to classroom teaching and learning that is designed to engage students in investigation of complex, authentic problems and carefully designed products and tasks.

Gultekin (2005) aimed to investigate the effects of Project Based Learning (PBL) on fifth grade students' learning outcomes. He found out that the PBL made students happy during the learning process by providing them with rich learning experiences. Bas & Beyhan (2010) also indicated that students had more fun when they were learning through project-based method because they touched, saw, and spoke about the things that they learnt and they also had the change of socialisation and cooperation which are more important for them in these ages.

IV. METHOD

The main body of a research is the methodology. Every research has its own methodology to obtain the findings. As for this research, the researcher uses Design and Development Research (DDR) approach by (Richey & Klein, 2007). This approach not only lets researchers plan a study in a logical way, but also gives them the freedom to use different instruments and research methods at each phase. It included three phases of DDR which are phase one: need analysis, phase two: design and development and phase three: implementation and evaluation.

Design and Development Research (DDR) was described as a way to establish new procedures, techniques and tools based on specific needs analysis (Richey & Klein, 2007). It is also used to design and develop an intervention (such as programs, teaching learning strategies and materials, products and system) with the aim to solve a complex educational problem and to advance our knowledge on the characteristics of these interventions and the processes to design and develop them (Plomp, 2013).

Science and empiricism offer a more effective and trustworthy path to disciplinary integrity than artistic strategies and craft-based solutions. As a science, design and development must adhere to principles derived from replicated empirical research. The models and procedures ought to be verified so as the identified problems' solutions should be supported by data (Richey & Klein, 2014). In other words, this design and development research (DDR) refers to the systematic study of design, development, and evaluation processes with the objective of establishing an empirical foundation for the creation of instructional (Hung et al., 2010) and non-instructional products and tools, as well as new or improved models that guide their development (Richey & Klein, 2008).

Richey and Klein (2014) also mentioned that many studies in design and development research (DDR) can be thought of as using more than one method which used to be known as multi-method. The term "design and development research" is used to describe a broad category of studies that make use of both qualitative and quantitative approaches. However, most design and development studies employ qualitative methods and focus on actual projects, as opposed to hypothetical ones.

Phase 1: Need Analysis

The goal in this phase is to determine the needs to design and develop the Project Based Learning: Instruments and Rubrics for Autism (PBL-iRA) in learning English Language in primary schools. The instruments of need analysis in this phase adapted from Discrepancy Model by McKillip (1987). Needs are decisions about what's important: that a group of people has problems that can be solved (McKillip, 1987). The need analysis is a strong tool that may be used to decide whether or not the services that are currently being provided to the people are appropriate. If services of this kind are inadequate while at the same time a remedy is available, then there is a demand (Arumugam, et al.,2019).

Needs analysis is not a current method among researchers yet has long been a crucial tool in educational planning (Shuib, et al., 2010). In the fields of education and human services, one useful technique for decision making is needs analysis, which entails the process of identifying and evaluating various needs. Decisions can encompass a wide range of topics, including the distribution of resources, the provision of grant funds, and the formulation of plans. In other words, needs assessment is a process that involves evaluating the issues that have been discovered as well as the potential solutions for a certain group. Throughout this procedure, it places an emphasis on the significance and applicability of the challenges and the answers. Thus, needs analysis is conducted to determine the difference between the existing condition and the desired situation.

The needs analysis survey will involve 30 teachers and 30 parents of students with Autism. The researcher will apply purposive sampling method in selecting the respondents. According to Berliner (2004), a teacher can be considered a specialist in their profession if they have spent between five and ten years working in that sector. Therefore, the inclusion criteria of teachers are; (1) they must have at least five years' experience teaching Autism students; (2) they are teaching English Language; and (3) they are teaching in Sekolah Kebangsaan Pendidikan Khas (SKPK) or Program Pendidikan Khas Integrasi (PPKI). On the other hand, the inclusion criteria for parents are (1) they have Autism child; (2) their child studying in SKPK or PPKI; and (3) they can understand Malay and English. All of them must be voluntary to be involved in this study. The survey of needs analysis will be formed in the format of open-ended questions developed by the researcher based on the literature study. Before the survey questions handed to the teachers and parents of students with Autism, it will be validated by three curriculum experts to determine its construct validity.

Phase 2: Design and Development

Design and development phase is the core part of the research. Akker et al. (2006) explained that this phase was critical and should be highlighted because the developed products, whether modules, models, or curriculum, were relevant and required detail to ensure they benefited the actual target audience. In this phase, the researcher will build the constructs and items in the instruments based on the Kurikulum Standard Sekolah Rendah Pendidikan Khas (KSSRPK), adopting the approach of Stoller (2002) by implementing ten-steps process of doing project work in learning English Language and the literature reviews.

Nominal Group Technique (NGT) and Fuzzy Delphi Method (FDM) will be carried out in this phase. Nominal Group Technique (NGT) will be organized to design the constructs and items as NGT is a method that makes possible for a team or group quickly come to a consensus on the relative importance of issues, problems, or solutions by aggregating individual importance-ranking into a team's final priorities (Odu, 2017; Varga-Atkins, et al., 2017). Ten experts will be invited to sit in a round table to evaluate the constructs and items of the PBL-iRA. In fact, NGT should be formed comprising of 9 to 12 persons who are expected to be knowledgeable about the issue for which the session is convened (Allen, et al., 2004). The researcher suggests that this phase shall involve ten experts who expertise in the field of special education, instrumentation and evaluation, and paediatrician. The criteria applied in this phase in choosing the experts (1) have more than five years' experience in the expert filed; (2) had done publication and research in this area; or (3) have more than five years' experience in teaching English Language for special education.

Once the draft of the Project Based Learning: Instruments and Rubrics for Autism (PBL-iRA) in learning English language has been designated, it will be sent to the experts that had been acknowledged earlier for Fuzzy Delphi Method (FDM). FDM is a decision-making analytical approach that blends fuzzy theory with the conventional Delphi approach. This approach is a way for acquiring structured data that is based on a group of experts and is used to examine and gather opinions in order to come to an agreement on a certain piece of information (Yousuf, 2007). Padzil et al. (2021) stated that

expert consensus is also obtained via the Fuzzy Delphi Method for module prototyping, software/hardware development, and the design of instructional materials and learning strategies. The criteria to select experts are same as in NGT method; (1) have more than five years' experience in the expert filed; (2) had done publication and research in this area; or (3) have more than five years' experience in teaching English Language for special education. The experts who are invited to join this study do not know each other. This characteristic of anonymity is to ensure that all of the experts are able to express their opinions without bias or affected by any other experts.

During this phase, the experts will be attached with the consent form and the checklist for main construct and items of the PBL-iRA. This checklist is designed with seven-point Likert scale to allow the experts to give ideas, critics, and make enhancement on the learning objectives, appropriate lesson content, activities, and rubric of assessment in the instrument of PBL-iRA. According to Saido et al. (2018), there are three primary factors that are utilised to approve or reject an item that has been accepted by the experts;(1) the Triangular Fuzzy Numbers section, are inextricably linked (Hsieh et al., 2004), (2) the Defuzzification Process section, which examines the significance of the score in relation to the importance of an item (Abdelgawad & Fayek, 2011; Mourhir et al., 2014), and (3) an item is considered to be acceptable if the value of the deal by the expert group is greater than 75% (Benitez et al., 2007). Based on the findings from the experts, the researcher will design and develop the PBL-iRA that can contribute to the society especially to the students with Autism in improving their skills in acquiring knowledge.

Phase 3: Evaluation

Throughout this phase, the evaluation of Project Based Learning: Instruments and Rubrics for Autism (PBL-iRA) in learning English language will be carried out via the semi- structured interview method by adapting the TUP model of Roman Bednarik (2002) in evaluating educational software. This model was chosen because it is appropriate for evaluating a module/instrument as a whole based on the complete separation in the aspects of technology, usability, and learning. The PBL-iRA prototype instrument was used in this phase to conduct a total of eight teaching and learning sessions over the course of two months. It includes the stage prior to the implementation of the instrument as well as the stage following.

In the first session, interview questions on demographic background, experience, facilities, and digital technology skills are being asked. In the second session, user retrospection was used to conduct interviews linked to three parts of the TUP Model (technology, usability and learning). The interview instrument is not limited to the three characteristics mentioned above, but also contains other perspectives such as the PBL-iRA's strengths and shortcomings.

V. CONCEPTUAL FRAMEWORK

Figure 1 shows the conceptual framework of this study. Project Based Learning: Instruments and Rubrics for Autism (PBL-iRA) will be designated and developed based on three educational theories, which are Vygotsky's Social Constructivist, Gardner's Multiple Intelligence and Dewey's Learning by Doing. In this research, the researcher will analyse the needs of having PBL-iRA in the subject of English language in Special Education primary schools and later, design and develop the module of instrument and rubric. The research design for this study is Design and Development Research (DDR) approach. Three phases in DDR are; (1) phase one: needs analysis; (2) phase two: design and development; and (3) phase three: evaluation. Needs analysis in phase one used to identify the needs to develop the instruments and rubric for PBL. During phase two, Nominal Group Technique (NGT) and Fuzzy Delphi Method (FDM) will be administered to design and develop the constructs and items in the PBL-iRA including the learning objectives, appropriate lesson content, activities, and rubric of assessment. Lastly, in phase three, semi-structured interview will be conducted to evaluate the usability of the PBL-iRA in learning English language.

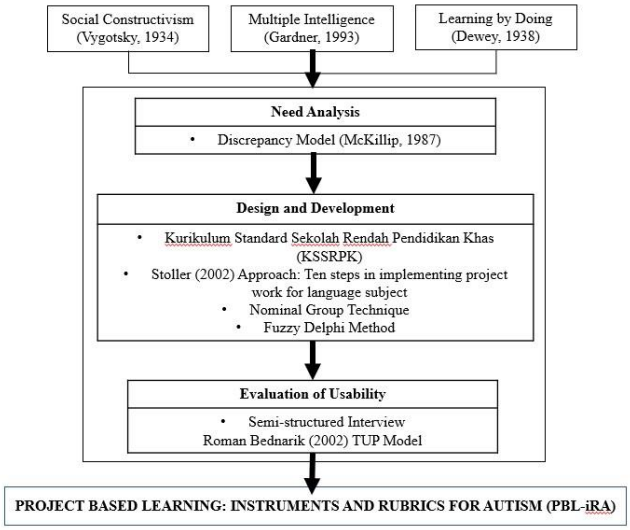

Figure 1. Conceptual Framework of Project Based Learning: Instruments and Rubrics for Autism (PBL-iRA)

VI. DISCUSSION

The assessment of students in doing project, needs to be aligned to the distinctive characteristics of the Project Based Learning (PBL) process and outcomes. Teachers need to identify appropriate assessment moments where they can first generate "teachable moments" (Lehman et al., (2006). Hmelo-Silver et al. (2007) emphasized that teachers need to build students' confidence and competence in the project process by providing them with formative scaffolds.

Assessment in Project Based Learning (PBL) has been referred to as "authentic" by Bell (2010) which means that in addition to measuring a child's performance using rubrics, the primary focus is on reflection, self-evaluation, and evaluation by peers. Self-evaluation skills

can help students learn to regulate their own learning and take ownership of the process of learning (Ertmer & Simons, 2005).

Smit and Birri (2014) stated that by using rubrics to evaluate complex skills in the classroom could make sure that all standards are covered and that teachers can assess their students' skill levels in a valid and reliable way. Thus, to achieve the standards of rubric, teachers need to develop good lesson plans that meet the national standards. Educational standards are frequently based on competence models and outline the minimum competencies that students should have by a specific grade level. The following figure is the theoretical framework and the relation between standards, tasks and rubrics based on Smit and Birri (2014).

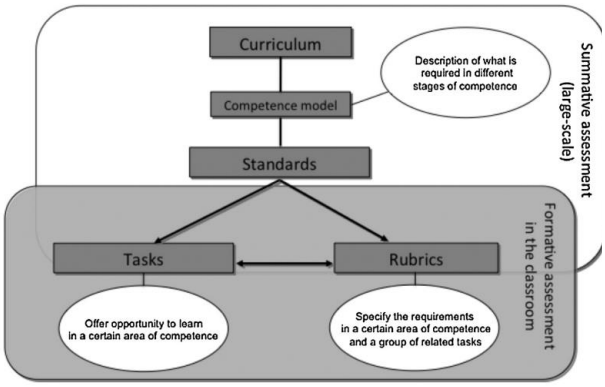

Figure 2. Smit and Birri (2014) Theoretical Framework and The Relation Between Standards, Tasks And Rubrics.

Smit and Birri (2014) also indicated that there are two different types of rubrics which are holistic and analytic. Holistic rubrics provide a single score that is based on an overall impression of a student's performance on a task, whereas analytic rubrics provide precise feedback on numerous aspects and levels. Pan (2016) referred the holistic rubric as impressionistic or global scale while Griffith and Lim (2016) claimed that the holistic rubric is concerned with assigning an overall grade that takes the performance as a whole into account. Clearly, the holistic method of scoring is less time-consuming and less complex than the analytical method.

TABLE I: HOLISTIC SCORING RUBRICS FOR STEM PROJECT BASED LEARNING

Rating	Brief Description
1. Nascent	Student displays preliminary knowledge and skills related to the learning task.
2. Constrained	Student displays limited knowledge and skills related to the learning task.
3. Developing	Student displays a developing level of content and concepts related to the learning task.
4. Commendable	Student displays functionally adequate attainment of the content and concepts related to the learning task.
5. Accomplished	Student displays mastery of the content and concepts related to the learning task.
6. Exemplary	Student displays a novel or personal level of mastery of the content and concepts related to the learning task.

Adapted from Capraro and Corlu (2013)

An analytic or profile rubric aimed to segregate notable properties of execution and assess each one exclusively and freely on its own subscale; the analytic approach focuses on discrete characteristics of execution, normally mixing scores on the detached subscales to generate an overall score, and sometimes reporting the sub-scores too in order to give more extravagant and richer dimension of source (Taylor & Galaczi, 2011). On top of that, using analytical scoring improves the accuracy of evaluation (Dogan & Uluman, 2017).

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