

**Transforming Technical and Vocational Education and Training
(TVET) students towards 21st century skills through
Constructivist Learning Environment (CLE)**

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Abstract

Technical and vocational education and training (TVET) in Malaysia is currently within the 21st century environment where teachers and students are expected to be highly prepared in technological skills and competencies. The literature suggested plenty of reasons for TVET to be transformed towards 21st century skills and learning. The most important reason is to prepare TVET educators and students towards the advancement of new technologies, skills, knowledge and cope with rapidly changing technologies in workplaces. In order to move towards 21st century learning, it is suggested that an appropriate framework need to be established by recognizing the educators' and students' need as well as the teaching and learning environment. The aim of this article is to briefly overview the idea of transforming TVET students towards 21st century skills by implementing constructivist learning environment (CLE). This article proposed a theoretical framework based on Activity Theory and a conceptual model for 21st century TVET students in order to support the strategies in enhancing Malaysian TVET system towards 21st century education.

Keyword: 21st century skills, Constructivist Learning Environment, Activity Theory, TVET

Introduction

Process of learning should be very interesting with multiple activities need to be applied in the teaching and learning session. Chickering and Gamson (1987) suggested that learning is not a spectator sport. They further implied, “Students do not learn much just by sitting in class listening to teachers, memorizing prepackaged assignments, and spitting out answers. They must talk about what they are learning, write about it, relate it to past experiences, and apply it to their daily lives. They must make what they learn part of themselves” (Chickering and Gamson, 1987, p. 3).

In order to make classroom interesting, instructors must prepare activities that would be able to attract students to actively involve in the learning activities. According to Swanson et. al. (2007), the use of the term “active learning” by educators relied more on intuitive understanding than a common definition. Thus, many educators claim that all learning is essentially active and students are actively involved listening to formal presentations in the classroom (Swanson, Cano, Samy, Hynes, & Swan, 2007). Chickering and Gamson (1987) stressed that students must do more than just listen. They must read, write, discuss, or be engaged in solving problems. Therefore, strategies that promoting active learning be defined as instructional activities involving students doing things and thinking about what they are doing (Chickering et al., 1987).

The global education systems are moving towards 21st century teaching and learning where there is increasing needs for educator and students to survive in the new era. The 21st century skills are crucial to many educational fields and many countries had streamlined their education towards 21st century education. In transforming Malaysian educational systems towards 21st century skills, Ministry of Education, Malaysia are also in the process of preparing teachers, learners, schools, and organization towards 21st century skills. Educational institutions are also encouraged to be involved in the transformation include the Technical and Vocational Education (TVET). TVET in Malaysia are now initiated the steps towards 21st century education, providing 21st century skills to produce 21st century competent workforce.

In order for TVET to prepare for the next era, it is suggested teachers and students in Malaysia are prepared with the skills, knowledge, attitudes and values that are commonly required for workforces in Malaysia and worldwide. There are many researches, studies and conferences that demonstrate the potential to in transforming TVET towards 21st century education. In the work by Dason et. al (2010), they have reviewed the paths gone through by Technical and Vocational Education in Malaysia. According to them, major problems occurred in Technical and Vocational Education consist of lack of engagement with related industries, lack of educators who have experience in the industries, lack of funds and policy to support Technical and Vocational

Education, negative impression in Technical and Vocational Education, and curriculum is not effective and flexible. Furthermore, Dalton et.al have reviewed implementation strategies to strengthen TVE and also the upcoming TVE roadmap as in Figure 1 and Figure 2.



Figure 1. Implementation strategy to strengthen TVE
(Source: International Forum on Vocational-Technical Education)



Figure 2. The upcoming TVE roadmap

(Source: Division of Technical and Vocational, MOE: 2008)

Transformation in TVET in supporting nation's wish

TVET in Malaysia has gone through several phase of development. Zainudin et. Al (2012) stated that,

“Malaysia is developing in rapid rate confronted drastic challenges with fundamental changes. Successful stories created after one another in various fields. However, one of important factors to attract foreign investors is skills and technical competencies in local workforce. The Government is responsive towards this demand which been aware that it does not only depending on educated workforce, but also on having a large pool of skilled workers with first class talent base. Technical and Vocational Education and Training (TVET) is responsible towards this demand. Thus, programmes offered, course outline and also curriculum use must be aligning in producing high skilled workforce for industry. Cooperation between the Government and industry is critical in ensuring the curriculum produced is counterpart each other”

(Zainudin, Zuhaili, Saud, & Nordin, 2012, pp. 20).

These statements shows that the need of skills and technical competencies in employees to successfully raise together the country. Therefore, to support the Malaysian government's needs for educational transformation, education sectors play an important role to produce graduates that are skilled and possess high confidence level to continue the nation's wish to be one of the developing countries.

Innovation in Technical and Vocational Education

Theoretical knowledge alone is insufficient for individuals to be able to become competent or proficient in hands-on skills. In general, the most practical work in real working environment is different from the theory learned. Kayan, Hamzah & Udin (2010) study in a Malaysian Polytechnic found that at present, industries demand for skilled workers not only to students who could masters theories alone, but they need students to master the practical work as well. Instructors will be seen as a leader when they are able to produce skilled employees for the relevant industries. (Kayan, Hamzah, & Udin, 2010).

21st Century Skills

21st century skills are commonly being discussed especially in educational institutions. The rationale for formulating 21st century skills has been summarized in the table based on Dede's(2010) comparison between 20th century & 21st century skills.

Key components	20 th century skills	21 st century skills
Capabilities people need for work	✓	✓
Citizenship	✓	✓
Self-actualization	✓	✓
Emergence of every sophisticated information and communication technologies		✓ eg: types of work done by people-as the kinds of labor done by machines- shifted as computers and telecommunications capabilities can accomplish human tasks
Knowledge communicated in schools		✓ Creating new “contextual” skills unique to millennium work and citizenship

Table 1. Summary of the difference of 20th Century and 21st Century skills

From the table, it is highlighted that the 20th century skills are focusing on technologies and communication as well as type of knowledge communicated in schools. The 21st century skills are suggested to create new contextual skills which is meaningful for millennium work and citizenship.

Overview of 21st century learners and environment

In the process of transforming TVET student towards 21st century, firstly there is a need foreducators to identify 21st century learners and environment. Levin, Ben-Jacob and Ben-Jacob (2000) suggested that college students in the 21st century are individuals with large number of commitmentsin pursuing their education. They further implied the 21st century students are more mature, financially self-supporting, and more serious in academic compare to current students, do not stay in campus and have no time to go back and forth to campus. This type of students are more into the technology wise and prefer

technologically mediated learning such as distance learning, as suggested by Levin, Ben-Jacob, & Ben-Jacob, 2000 in the 21st century, distance learning will be a common way of learning because they are academically independent.

Compared to today's traditional classroom environment, the 21st century students are more self-motivated and will be able to voice out their questions and better in discussing academically in subject matter (Levin et al., 2000). Educators will have to be prepared of the changes to happen and willing to support the positive changes especially in education field. Our traditional view of education will be slowly be changed by the tremendous opportunities in the next era. Chalk and talk will be surpassed in functionality (Levin et al., 2000). Therefore educators must apply the vision and mission of teaching and learning and must support the changes that will happen in the society and not just saying the vision through the lip and forgetting them (Levin et al., 2000).

Frameworks of 21st century skills

The work of Dede (2010) has compiled some framework exist regarding 21st century skills and education (Dede, 2010). Comparison has been made between Partnership for 21st Century Skills (2006), the Metiri Group and NCREL (2003), the American Association of Colleges and Universities (2007), and the Organization for Economic Cooperation and Development (2005). There are also some frameworks in the area of information and communications technology which includes the revised ISTE student standards for technology in the curriculum (2007), and digital literacy standards from the Educational Testing Service ICT Literacy Panel (2007). Furthermore, there are also individual scholars being compared such as Dede (2005) and Jenkins et. al. (2006).

All the mentioned 21st century skills framework address the core subject that being focused especially mathematics, science, geography, history and many other subjects. But none are focusing on technical and vocational education subjects. Each of the frameworks is generally consistent with each other. The most important issue that is the focus on preparing, implementing 21st century skills in educations, what should be added in the curriculum, the importance of information and communication technologies, incorporating autonomous actions by students and 21st century skills to be trained into students learning and teachers teaching. They are also contributing towards knowledge based economy.

The compilation of these frameworks has made an important contribution in the re-conceptualizing the education for the 21st century (Dede, 2010). However, the technical and vocational education, is less discussed. It is suggested by this article, it is important to address an appropriate framework in transforming the technical and vocational education and training (TVET) towards 21st century skills.

From the comparison made, this article tried to apply the concept of the Partnership of the 21st Century Skills as the base to transform TVET towards education in

21st century skills. The reason is that the framework comprise almost complete elements compared with the other frameworks. The most important factor, however, is to address in producing life skills for TVET students in the 21st century. Figure 3 shows the 21st century student outcomes and support systems.

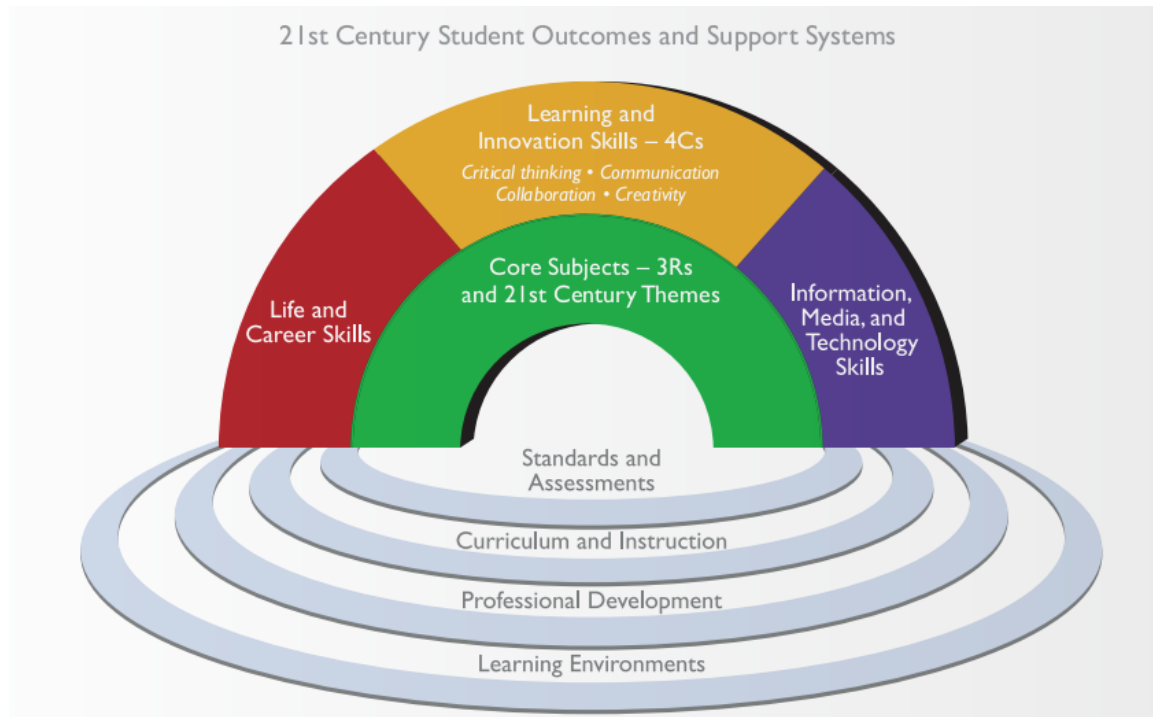


Figure 3. 21st Century Student Outcome and Support System
(Source: www.p21.org/overview/skills-framework)

The objective of this framework is to help practitioners to integrate skills into teaching of core academic subjects. This Framework of 21st century learning describes the skills, knowledge and expertise students must master to succeed in work and life and it is blend a blend of content knowledge, specific skill, expertise and literacies (Partnership for 21st Century Skills, 2011). Within the 21st century skills, students are suggested to learn essential skills such as critical thinking, problem solving, communication and collaboration to success in today's world. The cores of this framework are mastery of core subjects and 21st century themes, learning and innovation skills, information, media and technology skills and most of all is the life and career skills. This framework is complete with the 21st century support system which is the vital part of transforming students towards 21st century skills. The Partnership has identified five critical support systems to ensure student mastery of 21st century skills. The support systems suggested by the partnership are:

- 21st century standards

- Assessments of 21st century skills
- 21st century curriculum and instruction
- 21st century professional development
- 21st century learning environment

From these support systems, this article will focus on the 21st century learning environment in which the support system can be created by teachers or instructors in the process of constructing students' knowledge and skills. In the next section, this article will stress on a theory and a model that is suitable to be used to build a specific framework for 21st century TVET students focusing on the learning environment support system.

TVET towards 21st century skills: Current Issues

There are several discussions concerning transforming TVET towards 21st century. The main concerns are the students and teachers, and the challenges faced by them in the 21st century education. Razali (2010) suggested that the greatest challenge to the TVET should be addressed is to ensure to achieve developed nation status in 2020. It can be seen that the foundation of vocational education in Malaysia has been built up to enable educators to plan and move towards that goal. However, the challenge in the coming years, especially in the economic crisis facing the country today, vocational educator should have the competitive and sensitive to the changes occurring around it (ref). Educated population will strengthen the economy and the strong economy builds a respected country in the world" (Razali, 2010). This statement shows that TVET are facing great challenge in moving towards 21st century. He emphasizes the educators or teachers should play the important part in solving this issue.

Furthermore, Dason et. al, (2010) in their work has clearly revealed the anomalies occurred in TVET and strategies to overcome the anomalies. Table 2 shows the anomalies, strategies, and changes in TVE system to improve TVE (Dason et. al, 2010).

Table 2. Anomalies, Strategies, and Changes in TVE system to improve TVE

Anomalies	Strategies	Changes in TVE system
lack of engagement with industry	establish good relationships with relevant TVE industry	Development of the use of Information Technology in TVE curriculum also needs to be developed
shortage of educators who have experience in the industry	Practical training of teachers in the industry	Setting in skills
lack of funds	Increase management	Developing the community

	efficiency	colleges
Lack of policy to support PTV	Support continuing education: non-formal, expand services	Formation office specifically dedicated to the TVE
negative impression in PTV	Articulation	The establishment of the National Training Center, Body, Regulation, Fund
negative portrayal of blue-collar jobs	Promote lifelong learning approach	Adoption of competency-based
curriculum is not effective and flexible	Increase research and development capacity	Qualification and certification systems

In order to solve this problem, TVE has prepared a roadmap as shown in Figure 1 and 2 to improve the TVE system.

The work of Shyamal (2012) has addressed the challenges in TVET teacher education which presents a radically different economy and society, which is likely to have profound implications on Technical Vocational Education and Training (TVET). Shyamal suggested that the expectation of knowledge economy and changing views about the nature of knowledge must be integrated in education and training, particularly in TVET, to be relevant for learners of the twenty-first century. Under this circumstance, an entirely new package of educational content, new set of skills and new methodologies for delivery are emerging as among the greatest shifts in paradigm in teacher education (Shyamal, 2012). Again the key for solving this issue stresses on teachers in order to make changes to the TVET education in 21st century.

Furthermore, TVET need to be strengthened in order to produce innovative TVET teachers for 21st century students (Razali, 2010). As in 21st century, the teaching and learning method in more towards student centered learning (Razali, 2010). He added that “Competency Based Assessing Projects is a resource designed for those committed to the method of teaching and learning. Confronting a never-ending supply of digital devices and overwhelming amounts of information, individuals in today’s society must be proficient in a variety of skills and strategies that were not critical for their grandparents’ success”. Regarding the matter, teachers should identify the 21st century skills required as shown in Table 3 (Razali, 2010):

Table 3. 21st century skills for strengthening TVET teachers and students (adopted from Razali 2010)

Skills	Justification
Accountability and Adaptability	Exercising personal responsibility and flexibility in personal, workplace, and community contexts; setting and meeting high standards and goals for one's self and others, tolerating ambiguity
Communication Skills	Understanding, managing, and creating effective oral, written, and multimedia communication in a variety of forms and contexts
Creativity and Intellectual Curiosity	Developing, implementing, and communicating new ideas to others, staying open and responsive to new and diverse perspectives
Critical Thinking and Systems Thinking	Exercising sound reasoning in understanding and making complex choices, understanding the interconnections among systems
Information and Media Literacy Skills	Analyzing, accessing, managing, integrating, evaluating, and creating information in a variety of forms and media
Interpersonal and Collaborative Skills	Demonstrating teamwork and leadership; adapting to vary roles and responsibilities; working productively with others; exercising empathy; respecting diverse perspectives
Problem Identification, Formulation, and Solution	Ability to frame, analyze, and solve problems
Self-Direction	Monitoring one's own understanding and learning needs, locating appropriate resources, transferring learning from one domain to another
Social Responsibility	Acting responsibly with the interests of the larger community in mind; demonstrating ethical behavior in personal, workplace, and community contexts

In conjunction with the 21st century skills, the teachers have to prepare body and mind to step towards the new paradigm of 21st century education in the TVET teachers'

development. However, there are several challenges and critical factors that have been identified and need to be solved. Table 4 clearly shows the challenges as mentioned with the variable of “highly skilled educator” that need to be solved in the TVET at global (Razali, 2010).

Therefore, from these issues, it is clear that in order to produce 21st century skill TVET students, the teachers are the one need to undergone a new paradigm in teachers’ development. Shyamal (2012) suggested that the main changes to be made are to the TVET’s in-service teachers and the TVET’s students (teacher to be) in surviving the 21st century environment by providing ‘agent of change’ which are teachers e teachers who are well trained.

All these problems have to seriously be considered in order to produce 21st century TVET students as well as to improve the TVET system towards 21st century. By identifying the problems and suggesting strategies and roadmaps, the framework in producing 21st century skills TVET students’ need to be developed. The next section will be discussing the suitable framework to be used as the base of this matter.

Theoretical Framework

To start with, the author will discuss this section starting from elaborating meaningful learning, activity theory, and constructivist learning environment (CLE). The gist of this review is to produce 21st century TVET students and the important role identified in preparing the students are the teachers. Murchú & Muirhead, 2005 suggested that the 21st century teacher irrespective of his or her learning environments should recognizes the value of critical thinking at all levels of meaningful learning. Therefore, teacher is viewed as a powerful agent to change the student learning towards meaningful learning and prepare them to survive in 21st century. Learning must be meaningful to ensure the students gain what they are learning and they can construct their own knowledge.

Constructivist theorist suggested that meaningful learning occurs when learners actively interpret and construct their experience internally. Teachers role have changed from sage to guide, from giver to collaborator, from instructor to instigator (Murchú & Muirhead, 2005). Furthermore, Jonassen, et. al. (1999) stated that meaningful learning requires knowledge to be constructed by the learner, not transmitted from the teacher to the student (Jonassen, et. al., 1999). Figure 4 shows the attributes of meaningful learning that consist of interconnection of active manipulative, constructive, collaborative, intentional, conversational, complex, contextualized, and reflective. Table 5 shows the meaningful learning in detail based on Jonassen, et. al., (1999).

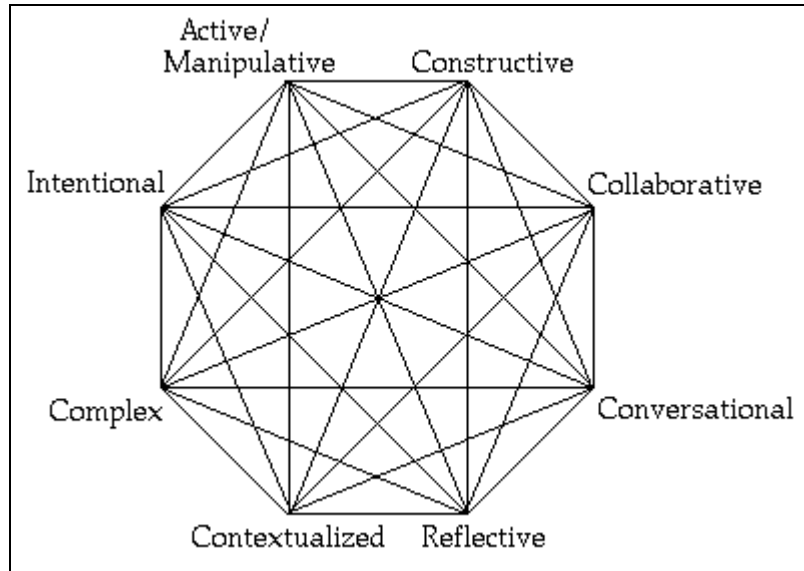


Figure 4. Attributes to Meaningful Learning

(Source: Murchú & Muirhead, B, 2005)

Table 4. Meaningful learning attributes and descriptions (ref)

Attributes	Description
Active (manipulative)	We interact with the environment manipulate the objects within it and observe the effects of our manipulations
Constructive and reflective	Activity is essential but insufficient for meaningful learning. We must reflect on the activity and our observations, and interpret them in order to have a meaningful learning experience.
Intentional	Human behavior is naturally goal-directed. When students actively try to achieve a learning goal that they have articulated, they think and learn more. For students to experience meaningful learning, they must be able to articulate their own learning goals and monitor their own progress.
Authentic (complex and contextual)	Thoughts and ideas rely on the contexts in which they occur in order to have meaning. Presenting facts that are stripped from their contextual clues divorces knowledge from reality. Learning is meaningful, better understood and more likely to transfer to new situations when it occurs by engaging with real-

	life, complex problems.
Cooperative (collaborative and conversational)	We live, work and learn in communities, naturally seeking ideas and assistance from each other, and negotiating about problems and how to solve them. It is in this context that we learn there are numerous ways to view the world and a variety of solutions to most problems. Meaningful learning, therefore, requires conversations and group experiences.

Therefore, students must to more in order to acquire meaningful learning. From meaningful learning, students will be able to construct their knowledge and will benefit more in their learning process. Besides meaningful learning, teachers also have to provide suitable activities and learning environment for their students. In the next section, the author will discuss the suitable framework and model to be used as the gist of this review.

Constructivist Learning Environments

Meaningful learning is closely related with constructivist learning environment. Jonassen (1999), has provided steps in designing constructivist learning environment that the author wanted to stress in this review. Here is brief review of constructivist learning environment from Jonassen (1999). The goal of this theory is to foster problem solving and conceptual development. This theory is based on these values:

- Learning that is driven by an ill-defined or ill-structured problem (or question, case, project),
- A problem or learning goal that is “owned” by the learner,
- Instruction that consist of experienced which facilitate knowledge construction (meaning making),
- Learning that is active and authentic.

In order to implement CLE, Jonassen has prepared steps to design CLE. The major methods this theory offers are (Jonassen, 1999):

Step one. Select an appropriate problem (or question, case, project) for the learning to focus on. The problem:

- should be interesting, relevant and engaging, to foster learner ownership.
- should be ill-defined or ill-structured.
- should be authentic (what practitioners do).
- design should address its context, representation, and manipulation space.

Step two. Provide related cases or worked examples to enable case-based reasoning and enhance cognitive flexibility.

Step three. Provide learner-selectable information just-in-time which means available information should be relevant and easily accessible.

Step four. Provide cognitive tools that scaffold required skills, including problem-representation tools, knowledge-modeling tools, performance-support tools, and information-gathering tools.

Step five. Provide conversation and collaboration tools to support discourse communities, knowledge-building communities, and/or communities of learners.

Step six. Provide social/contextual support of the learning environment.

To support learning CLE also offers three instructional activities which are:

- A. Model the performance and the covert cognitive processes.
- B. Coach the learner by providing motivational prompts, monitoring and regulating the learner's performance, provoking reflection, and/or perturbing learners' models.
- C. Scaffold the learner by adjusting task difficulty, restructuring the task, and/or providing alternative assessments.

The major contribution of this theory is the integration of much work in the constructivist arena into a coherent instructional framework (Jonassen, 1999). Constructivist conceptions of learning assume that knowledge is individually constructed and socially co-constructed by learners based on their interpretations of experiences in the world. Since knowledge cannot be transferred, instruction should consist of experiences that facilitate knowledge construction (Jonassen, 1999).

In his work, Jonassen (1999) presented a model on designing constructivist learning environment model that can engage learners in meaning making which is knowledge construction (Jonassen, 1999).

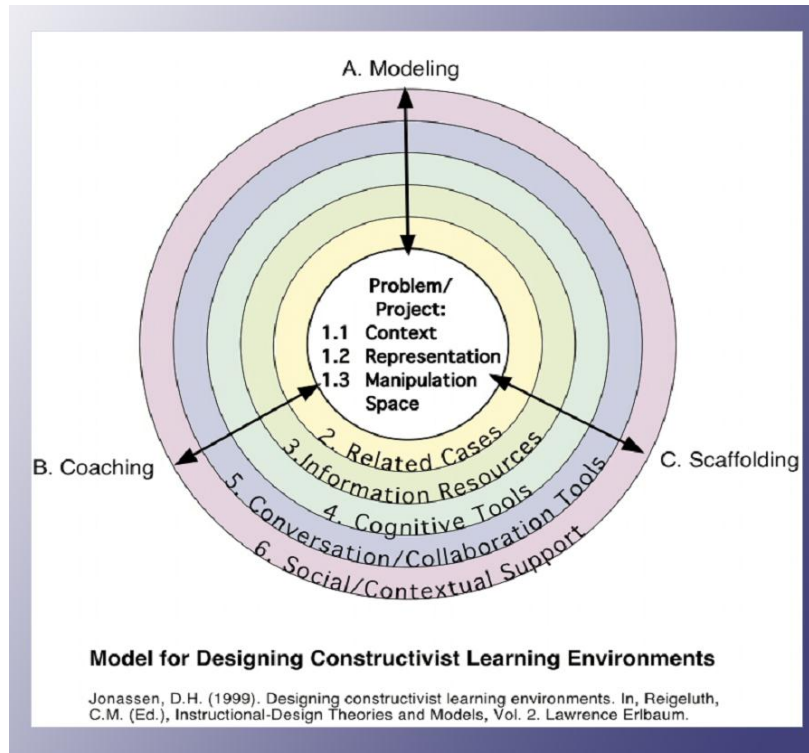


Figure 5. Model for designing Constructivist Learning Environments

Figure 5 illustrates six important components of the model as been discussed earlier. This model focuses on a problem or project or question as the focus of the environment, with the support of diverse interpretive and intellectual support systems surrounding it (Jonassen, 1999). Table 6 summarizes the key component of the CLE model (Jonassen, 1999). To produce 21st century TVET students, this theory is very suitable to be applied in TVET system. Therefore, in the next section, the author will discuss a framework comprising CLE and 21st century skills.

Table 5. Summary of constructivist learning environment model

Component	Function
1. Goal	The learner need to interpret and solve problem or complete the project
2. Related cases	support understanding of the problem and suggest possible solutions
3. Information resources	
4. Cognitive tools	help learners to interpret and manipulate aspects of the problem
5. Conversation/collaboration tools	enable communities of learners to negotiate and co-construct meaning for the problem

6. Social/contextual support systems	help users to implement CLE
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Research on learning approach using constructivist and social constructivist theory
Buntat and Yusof (2010) study reveal that teachers in technical schools and teaching technical subjects understood and applied the constructivist learning approach in their teaching and learning sessions. The mean was a high level of percentage. They also found that students were engaged with the constructivist learning approach and the performance of the students were encouraging. The students were more active in the teaching and learning sessions conducted using constructivist approach (Buntat & Yusof , 2010). Meanwhile Cook (1993) has made a thorough comparison between traditional classroom and the constructivist classroom which can be seen in Figure 6. The differences involved curriculum, learning resources, learning approach, educators’ role, evaluation, knowledge and also learners’ role.



Figure 6. The Traditional Classroom versus Constructivist Classroom

(Source: Cook, 1993)

Activity Theory

Activity theory was originally proposed as a theory of human consciousness and as an explanation of the nature of human behavior (Wilson, 2009). Human behavior consists of activities of one kind or another, and at the root of activity theory is the proposition that consciousness is formed through activity (Wilson, 2009). The origin of activity theory comes from Lev Semyonovich Vygotsky (1896-1934). His ideas are still widely applied in developmental psychology and educational research (Wilson, 2009). Figure 7 represents the activity theory emerged by Vygotsky's early work.

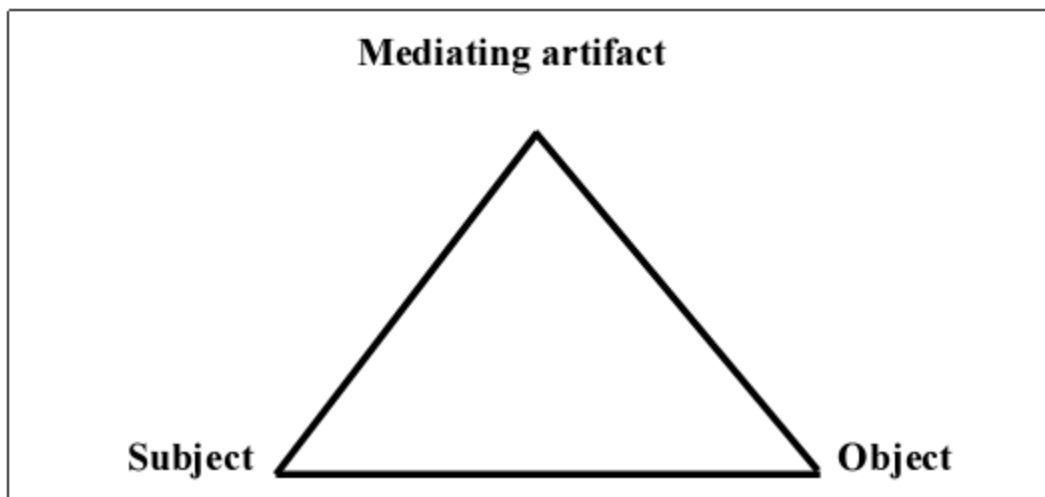


Figure 7. Vygotsky's activity theory

(Source: Wilson, 2009)

This figure is the famous concept of mediation by Vygotsky. During this stage, studies were focused more on individuals. This triangle represents the cultural artifacts with human actions in order to dispense with the individual or social dualism (Cole, 1993). Figure 8 shows the added triangle by Engeström which formulates the concept of rules and norms, community, and division of labor (Leontyev, 1977). The rules and norms comprise the formal and informal, legal, and traditional limits on and specification of the activity being undertaken (Wilson, 2009).

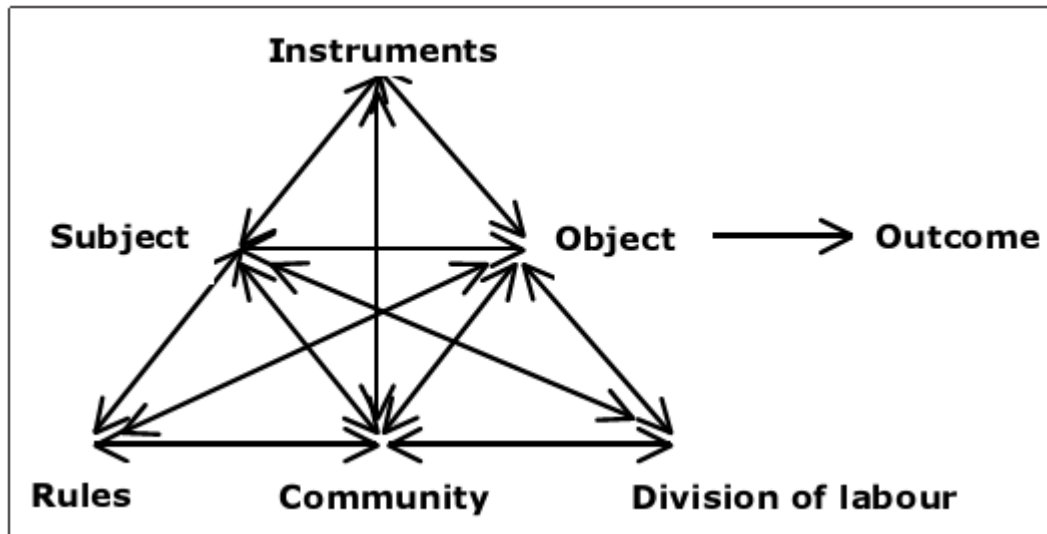


Figure 8. Leont'ev's activity theory as represented by Engestrom (1987)

As for the community, it can be elaborated at different levels such as the immediate work group or team of which subject is part, or it may be the wider organizational community, or society (Wilson, 2009). Furthermore, the division of labour relates to the performance of the activity involving collaboration and sharing tasks with others. These extensions shift the activity theory from individual and consciousness to activities within a community and a concern for development. In the development of 21st century skills, this theory seems to be a perfect based for a framework to improve TVET system.

TVET and activity theory

Curriculum Framework for vocational programmes currently focus on the sociocultural level of practice such as national competencies and national skills standards. However, Billet (2003) stressed that these vocational curriculum frameworks fail to account the actual manifestation and requirement of the vocational practice and how judgments are made regarding performance (Billett, 2003). Therefore, Billet (2003) in his work has proposed activity theory in improving vocational programmes.

Why Activity Theory?

Activity theory is suggest as providing richest framework studies of context in its comprehensiveness and engagement with different issues of consciousness, intentionality, and history” (Nardi, 1996). Research done by Billet (2003) has given some reasons in choosing Activity Theory. He stressed that rather than being unitary and objectively constituted, domains of human activity have diverse geneses, values and forms, even when an apparently common activity for example occupational practice is constituted and enacted in particular

circumstances. More than adaptability being focused on the skilful manipulation of individual's knowledge, there is a need to understand something of the diversity of the kinds of practices to which that knowledge might be applied" (Billett, 2003). This article suggests that in improving specific system such TVET system, diverse activities could be done where the activities involve multiple interconnections which will lead to meaningful and skilful manipulation of one's knowledge and then shared with the others. This provide a strong reason as why activity theory should be used as a framework of this review in order to transform the object which is the students to the desired outcome which is 21st century TVET students.

Issues in vocational practice: Curriculum and Pedagogy

Currently, the knowledge required for vocational practice is a product of cultural need and historical development with its specific manifestation being shapes by particular sets of situational and occupational constituted factors (Billett, 2001) for example, what constitutes vocational practice and what comprises the base and requirements of judgment of performance. Therefore, Billet (2003) mention that the account of vocational practice and bases for adaptability is incomplete without a consideration of situational requirements for work practice and vocational expertise. Billet further posted some questions with the aim of better formulating of vocational curriculum and practice. The questions that should be considered are on what basis should adaptability be considered, what should comprise bases for assessment and how provision of learning vocational practice best proceeds (Billett, 2001). Therefore, when the aim or goal is clearly stated, these questions must put into action. In transforming TVET students toward 21st century, the tools and environment should be 21st century. As for assessments and curriculum, all these have to achieve the standard of 21st century education and learning. These activities can be illustrated in a framework based on activity theory comprising constructivist learning environment and adaptation of 21st century skills framework of P21 that has been discussed in earlier section.

Process for applying activity theory for designing CLEs

After all the discussions made in previous sections, the author has found that it is very appropriate to apply activity theory in designing CLE in the 21st century for the goal of transforming TVET students towards 21st century. Therefore, with the objective being clear, the next step is to identify the steps in applying activity theory in designing CLE in 21st century. There are six steps in applying activity theory for designing constructivist learning environment (CLE) that Jonassen and his partner has recommend in their work (Jonassen et. al, 1999). The steps are:

- Step one: Clarify purpose of activity system
- Step two: Analyze the Activity System

- Step three: Analyze the Activity Structure
- Step four: Analyze Tools and Mediators
- Step five: Analyzing the Context
- Step six: Analyzing Activity System Dynamics

For easy understanding, the steps are shown in tables that can be seen in the attachment. The tables show the process of applying activity theory in designing CLEs. Since CLEs are created to instill, encourage and scaffold learning (Jonassen et. al, 1999), this framework is suitable and can be used in producing competence 21st century TVET students.

From the discussion, it is appropriate to use activity theory in transforming any learning environment to desired one by undergoing the six steps recommended by Jonassen et. al (1999). It is because activity theory can be used as a frame work since the components and the interrelationships with CLE are close. As for a whole, the researcher feels that activity theory is appropriate to be used as a framework in transforming technical and vocational education in constructivist learning environment. This process involves examining and elaborating several factors such as (Jonassen & Rohrer-Murphy, 1999):

- i. The activity structures engaged by work
- ii. The tools, rules, and symbol systems that mediate that work
- iii. The social and conceptual context in which that work occurs

The Theoretical Framework

In transforming TVET system towards 21st century skills, there are many aspects need to look but the author will focus into the aspect of transforming TVET students towards 21st century skills and teachers as the backbone. In previous section, constructivist learning environment is the most suitable model to be applied with the base of activity theory. Both of them are in the same umbrella of social constructivist. In the constructivist learning environment, the relationship between teachers and students is different where the role of teachers become more complex and students plays an active part and pay more attention in their own learning (Tse-Kian, 2003).

For general view of the activities involved in transforming TVET students towards 21st century skills, the author proposed a theoretical framework that using activity theory as the base of the system as illustrated in figure 6.

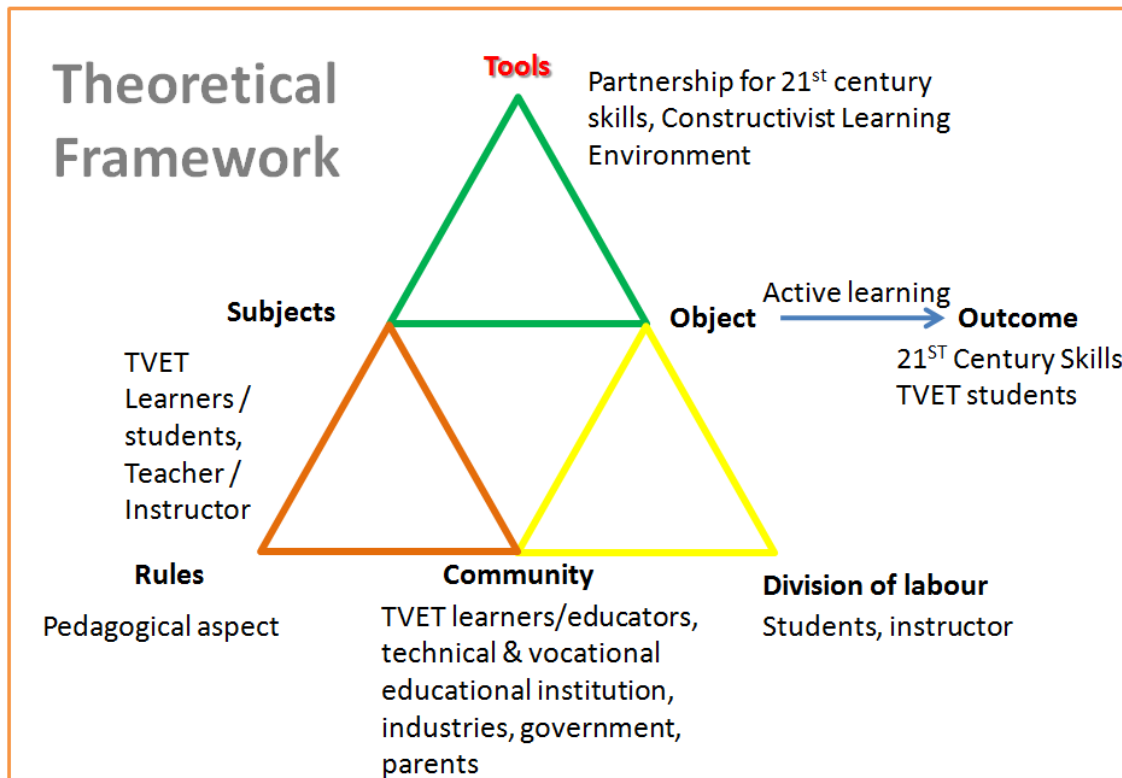


Figure 9. Theoretical Framework for transforming TVET students towards 21st century

In this framework, the outcome or goal is transforming TVET students towards 21st century skills TVET students. The subjects are the TVET students and also the teachers that play an important role as the “agent of change” (Shyamal, 2012). The activities of transforming the object towards desired outcome are mediated with the most important aspect which is the tools, rules, community, and division of labor. The author will focus more on the tools to be used in this framework to achieve the goal. The tools that have been chosen in this review are the Partnership for 21st Century Skills and Constructivist Learning Environment (CLE).

A conceptual model of the 21st century TVET students

In the process or activity in producing 21st century TVET students, the students should be able to learn in 21st century environment. It is the role of teachers to design a constructivist learning environment that can ensure the 21st century skills can be obtained by the students. Therefore, the author has come out with a conceptual model representing the learning mode as in figure 7. The centre of the circle referred to the goal of the process. All the circles are connected to each other showing that all activities are interconnected similar to the theoretical framework based on activity theory. This model describes the students’ learning environment by adapting constructivist learning

environment in 21st century. in order to produce 21st century TVET students, the author has viewed the whole environment in a large overview of 21st century skills, then find the connection with 21st century learning. Since the 21st century skills and learning emphasize more on constructing knowledge by learners for life, the most suitable model to implement is the constructivist learning environment.

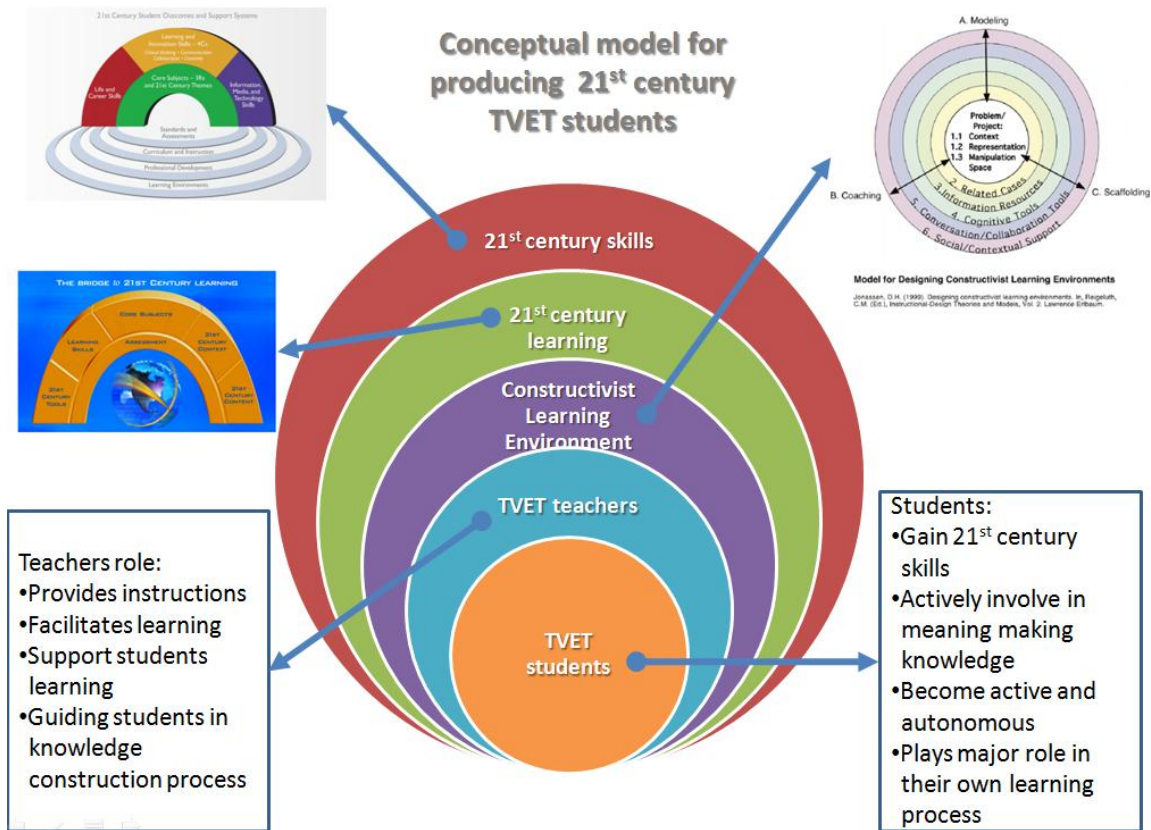


Figure 10. Conceptual model for producing 21st century TVET students

Teachers prepare the constructive environment for students learning process. This model also emphasizes the role of teachers in promoting constructivist learning environment towards 21st century. Teachers play an important role where they need to provide proper instructions, facilitate and support in students learning process, and most of all, guiding students in knowledge construction process. When the entire environment is suitable for 21st century students, this will ensure the outcome of this model can produce 21st century TVET students. From this process and activities, the students will gain 21st century skills, actively involved in meaning making knowledge, become active and autonomous, and primarily, students will benefit their own learning process because the students own the knowledge they construct.

Conclusion

Technical and vocational education is moving towards 21st century skills. Most issues discussed are regarding education towards 21st century. The aim of this paper is to give an overview on transforming TVET students towards 21st century skills by implementing constructivist learning environment. Overall, this paper has reviewed problems occurred in TVET system and strategies to improve the system and the challenges that TVET teachers face towards 21st century education. After identifying the anomalies in TVET system, the author has proposed a theoretical framework based on activity theory and a conceptual model for 21st century TVET students thus supporting the strategies in improving TVET system towards 21st century. The purpose of designing constructivist learning environment in activity theory is it can strengthens the meaning making knowledge by students with the help of teachers and learning environment and thus gains 21st century skills with the mediated factor of multiple active interactions for the same outcome.

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