

PAPER • OPEN ACCESS

The role of work characters on the creation of student technology

To cite this article: Y Ngadiyono *et al* 2020 *J. Phys.: Conf. Ser.* **1446** 012031

View the [article online](#) for updates and enhancements.



IOP | ebooks™

Bringing you innovative digital publishing with leading voices to create your essential collection of books in STEM research.

Start exploring the [collection](#) - download the first chapter of every title for free.

The role of work characters on the creation of student technology

Y Ngadiyono*, T Sukardi, B S Wijanarka, and D Rahdiyanta

Department of Mechanical Engineering Education, Universitas Negeri Yogyakarta, Indonesia

*yatin_ngadiyono@uny.ac.id

Abstract. Universitas Negeri Yogyakarta has a motto of leading in character education and this is manifested in the goal of creating a superior, creative and innovative learning process and environment that can empower students. In the same vision with those objectives, this study had two purposes; the first was to find the role of a character in the quality of the final product and determinants of work character on product quality. The research used to measure both research factors. A total of 56 diploma students became the sample of this study. The results showed that the character of work contributes to the quality of work of student technology. The research also indicates two aspects that contributed to the quality of the product

1. Introduction

Education is always attributed to preparing students for becoming a successful citizen, in any way possible. Reading, writing, and mathematics skills are paramount, so are the characters. Having self-control, patience, being honest, and being able to adapt to others, this has always been the feature that teachers expect to instil in their students, to date.

Moral intelligence applied in principles of ethics and personal purpose, values, and actions. Moral knowledge encompasses the competencies associated with integrity, namely, responsibility, forgiveness, and compassion. Developing higher moral intelligence will result in more healthy and positive individuals, schools, and social systems [1]. The main character in the education of technology to be planted is responsibility because students have expected to assume responsibility according to age. At the age of students demanded to be able to solve problems and liability. However, until now, the project works technology is a final task project of vocational students in Mechanical Engineering Department, with a load of 6 credit semester. The project is designed to make materials into a machine and or appropriate technology tool. Until now, there has been no research evaluating how the project impacts the development of the character. Current learning should also be able to contribute to pre-employment creation, pro-economic activities, pro-economic growth, pro-economic equalisation, and pro-welfare (pro-job, pro-activity, pro-growth, pro-distribution, and pro-prosperity)[2].

Therefore, the study of technological projects should be able to make innovators students. In any case, the creative ideas of an innovative person produce a definite competitive advantage and extraordinary wealth for prospective entrepreneurs [6]. Innovative products have expected to provide satisfaction to the needs of consumers. The student's challenge is how to fulfil all technological,



industrial, and economic needs. The demands of the industrial world do not efficiently perform if the students do not think critically, creative, and innovative.

Students' thinking and direction make the product a solution to face the 4.0 industry era as well as a challenge and opportunity. Student achievement produces appropriate technological tools to be the starting point for research to examine how product. The character profiles would direct obtain from product planning, process, and test performance. The collaboration of peers and interacting with the industry can provide distinctive value to the character and innovation power of the students. This research expected to give a real picture and become the starting point of potential student development.

CCR seeks a holistic approach to redesign the curriculum deeply, offering a complete framework across four dimensions of education: knowledge, skills, character, and metacognition [3]. Knowledge must achieve a better balance between traditional and modern subjects, as well as interdisciplinary disciplines. Skills relate to the use of experience and engage in feedback circles with knowledge. The quality of the character illustrates how one fights and behaves in the world. Metacognition encourages self-reflection and learns how to learn and builds three other dimensions.

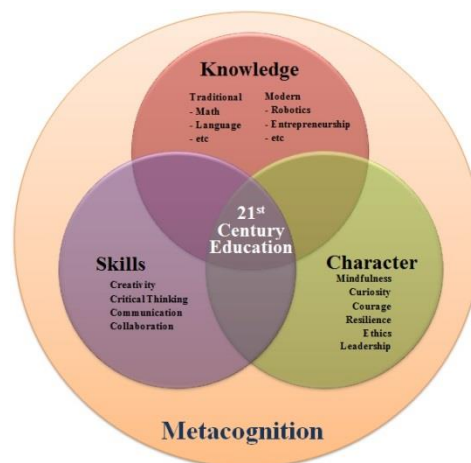


Figure 1. Linkage skills, knowledge, character, and metacognition [3]

Figure 1 illustrates the relation between skills, knowledge, character, and metacognition. In the 21st century, it has dynamic characteristics, which are interdependent student links, instability, imbalance, and volatility in the field of:

- knowledge of human culture, definite and social sciences
- intellectual and practical skills
- personal and social responsibility
- integrative and applied learning

The strategy of implementing character education that can apply in schools in four ways, i.e.: learning (teaching), the example (modeling), reinforcement (reinforcing) and habituating. Character education responsibilities will go a long way if the four methods are simultaneous and sustainable. It is also efficient when supported by parents, campus and the environment or community [4].

Marshall Welch suggests that preparing learners engage in the social environment is entirely aimed at generating new knowledge and skills such as how to solve problems and think critically [5]. At the same time, advances in science and technology are a double-edged sword. Although they provide many opportunities for global collaboration and progress, they also create new ethical challenges.

The student's sense of agency and self-efficacy must be trained. They are accountable for their feelings, actions, and experiences. It also means that responsibility for the consequences of choice and behaviour, whether successful positively or negatively, of course, without the blame of oneself or others. Confidence is needed to place and position yourself on the burden of the task it receives.

The foundation of building student confidence in the product requires the courage to accept any risk received. This responsibility is a manifestation of cognitive-based problem-solving. In the end, self-esteem and student thought and action will determine the sense of happiness and self-prosperity. Essentially, identity discovery is self-empowerment and begins to feel proud about itself, and is undoubtedly proud of its work. In the study of technology projects, the resulting products will give real confidence.

Personal responsibility for a project does not imply design mistakes or guilt but should cultivate a curious question about how and why the product specifications determined as the basics of cognitive. Finding solutions, gaining an alternative from assumptions that ultimately motivate student behaviour, and will be the consideration of decision-making in the future.

In the 4.0 industrial century, the old education pattern had to be removed and replaced with a new disposition to suit the needs and demands of today's learning. Learning should be able to provide colour to students for discoveries. This argument means that the design of education should direct at offering methodologies and instruments that can form material lessons for ideas and concepts in a pre-industrial phase of the production process [6]. New ideas and new concepts will produce an innovative new product design. This innovation is a result of creativity, and creativity is its roots. Engelberger stated that change would be meaningful when the need for a product is as recognised and performed by a competent person. Interestingly, the learning of computer-aided design/drafting in Indonesian education institutions is more focused on the aspects of its technology use, not on how the computer as a tool to develop innovations [7].

New product innovations are problem-solving activities geared towards a goal that relies heavily on human experience, creative thinking, and related knowledge. It has to do with integrating creativity and innovation tools with an axial design methodology for durable product development. Innovation will produce products that differ from competitors, and products are "product differentiation." "Product differentiation" through innovation will be able to press the market and become viral in the market. Changes that produce new products with specific qualities are better quality as well as competitive value. A research conducted concluded that the organisation felt it was essential to innovate and support the innovative culture [8]. Knowledge is also fundamental in the process of innovation because it represents not only valuable inputs but also the output of the transformation process.

Students of the new era must gain experience and make it an innovator. Dryer suggests that the catalyst so that one can become an innovator is through the stages: (1) questions that challenge the status quo. (2) observation of technology, company, or customer. (3) experiences or experiments in which he tried something the new or (4) conversation with someone who told him about essential knowledge or opportunities. The teacher means that students must be encouraged and facilitated so that they try to think about new things and try to solve new problems [9].

An innovator is usually creative. To be creative should not be talented. Smart is the grace of the Almighty, while the original is not. The results show that about two-thirds of innovation skills are learning outcomes [9]. It is this rationale that makes one more accomplished if it is in a community-based environment than the one which was based on individualism. The tip of the idea is a collaboration between one student and another, and a student with a community of prospective users of the product.

Technology of products will be of high value when meeting the criteria or demands of consumers and project users. The study of this technology project is an approach to project-based learning (PBL). This PBL, if maximised according to the context of education that resembles real-life meaning, then the material obtained will be beneficial in facing future challenges. Finally, when technology would apply in PBL learning, of course, learning and teaching will be progressive and spearheading the character of students.

The teacher thought it was only authenticated by the authenticity of the student's thinking." Dewey emphasises student roles in the educational process, and the part of teachers in guiding students through rigorous academic routines fits both individual tendencies and student abilities. Dewey suggests special activities, whether playing or doing useful work, in which individuals are interested.

Whose results they acknowledge that they have something at stake, and that cannot be done through without reflection and Based on individual assessments [10]. The student is a co-creator, i.e., as someone who is the problem solver [11]. The idea of collaborative troubleshooter is indeed an important one, and teachers and schools are working to capitalise. The characteristics of generations sharing, researching, evaluating, and collaborating with peers, more likely to Enact and inspire teaching practices that flourished in the 21st-century world.

The learning process, in general, is similar to the design process. A rapid change in society asks for openness and willingness and continuous learning ability. Capacity building is needed to help students learn to learn differently rather than learn more enterprising. Students need to directed to manage competency development, learning process, and learning activities. It requires the ability to orient themselves to what has already learned, to set self-learning objectives, to select appropriate learning activities (and sometimes create your own), plan, implement and monitor these activities, to analyse your learning outcomes in competency development terms and to evaluate whether to achieve goals set independently by students.

In the end, students should also be able to assess the development and competency growth of product designing. The self-management aspect of this competency will only run if the learner is responsible for their learning process. Learning-and designing-is a process of trial and success. In this case, the development of other competencies and independent learning is a process that will strengthen each other. The main advantages of the system are:

- Simplify the task structure so that the actions that may occur at any time are intuitive.
- Everything is evident, from conceptual models to feedback.

In product, design learning should be user-based and approachable with the concept of learning by discovery from Jerome Bruner and the idea of "student-centre learning" from Carl Roger. According to Bruner, the school is a cultural instrument that is essential for developing intellectual skills. Learning pressure was helping in the context of seeing and thinking around objects. Learning is also a live library, but it must give meaning and a chance of thinking. From thinking about problems around it, it will stimulate learners to be innovative creatives.

The user-based learning framework is a different learning framework with general learning. In the word study of user-based learning is not merely seen from the cognitive and motor skills alone. This learning also demands a sense of the existence of a product. Education refers to how learners understand or have a sense of information, understanding, and "having" key facts, concepts, generalisations, and skill subjects or problems [12]. The Sense of a product that has a value of selling and artistic value is something meaningful to learners.

The pillars of design learning are three, prediction, goal, and observation. This approach is not much different from the design approach. Diagram in figure 1 shows problem-solving science and technology. Visible functional relationships between 3-element-prediction (created by imagining in the mental experiment) and observation (created by actualised in physical operations) and goal (for satisfactory problem solutions).

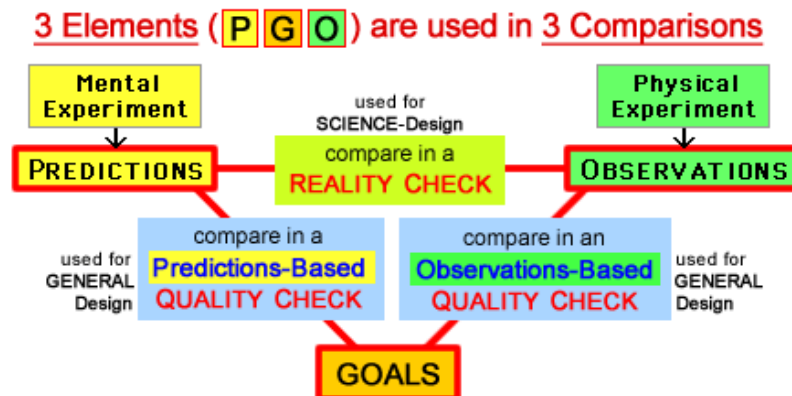


Figure 2. Prediction Goal Observation (PGO) system

The goal in design learning is so far in the form of 2D or 3D design drawings — images as enjoyable and as good as anything yet capable of providing proximity information to reality and imagination. In user-based design learning, the learning results are items or objects that could have confirmed through the observation of prospective users (user). With this approach, learners will get information as feedback on his work. Another advantage is if the product made with a scale of 1:1, then the product will have a selling value. The problem approach is where the creativity and sense of the product will make a meaningful donation. Sudjana presents five things that need to would have done in the application of learning so that the learners can solve the problem, which is focusing [13].

2. Methods

The subject of this study amounted to 56 diploma students at the Prodi engineering of UNY. The amount was obtained after checking the questionnaire completeness to be eligible for further analysis. The instrument uses a questionnaire based on the dimensions of the student's working character. Work characters are arranged based on the size of the task, patience, focus on detail, motivation and social relationships. The questionnaire uses five options of the answer, i.e., very concur (SS), agree (S), (C), less concur (KS), and disagree (TS). Estimate reliability using the coefficient of Alpa Cronbach while validity had tested with analysis factor.

Test the factor analysis begins by looking at the value of a Meyer-Olkin (KMO) Keiser, which is to see if the sample has been adequate. According to Singgih Santoso, if the MSA value is more significant than 0.5, then the variable is already adequate for further analysis. The MSA value must less than 0.5, and then the variables are not predictable, and unbiased are analysed further or removed from the factor. Further investigation by assessing the weight factor indicating the magnitude of the correlation and judging by the size of the loading factor greater than 0.5 [14].

3. Results and Discussion

Based on the initial analysis of output, SPSS 25 obtained the value of anti-image matrices (MSA) the value of 0.564, while based on anti-image matrices there is an attribute that must be eliminated because only obtained value of 0.361, namely the social relations variable attribute (P6). For that, the P6 variable is removed from subsequent analysis. In the advanced stage analysis or two (table 1) The anti-image matrices (MSA) value is 0.576 while based on anti-image matrices (table 2) no attribute should be eliminated because of only the smallest value of 0.519.

Table 1. KMO and Bartlett's Test

Kaiser-Meyer-Olkin measure of sampling adequacy.		.576
	Approx. Chi-Square	32.298
Bartlett's test of sphericity	df	10
	Sig.	.000

Table 2. Anti-image matrices

		P1	P2	P3	P4	P5
Anti-image covariance	P1	.744	-.169	-.069	.097	.265
	P2	-.169	.786	-.273	-.165	.088
	P3	-.069	-.273	.830	.172	-.069
	P4	.097	-.165	.172	.842	-.204
	P5	.265	.088	-.069	-.204	.761
Anti-image correlation	P1	.651*	-.221	-.088	.123	.352
	P2	-.221	.531 ^a	-.338	-.203	.114
	P3	-.088	-.338	.539 ^a	.205	-.086
	P4	.123	-.203	.205	.519 ^a	-.256
	P5	.352	.114	-.086	-.256	.597 ^a

*Measures of Sampling Adequacy (MSA)

Five variables are included in the analysis factor of phase two and have been seeing obtained eigenvalue more significant than one on 1 factor and two factors (table 3). With this criterion obtained the number of factors used, namely two factors. From the table above can be done interpretation related to the total cumulative sample variances. If those variables have been summarising into several factors, then the total value of the variances that could explain is as follows.

- If the five variables were have extracted into 1 factor, obtained the total variances that could have described are $1.902/5 \times 100\% = 38.039\%$.
- If the 5 variables are extracted into 2 factors, obtained the total variances that can be described are $1.153/5 \times 100\% = 23.069\%$,
- The total variances are $38.039 + 23.069 = 61.109\%$

Tabel 3. Component matrix

Component Matrix ^a			Rotated Component Matrix			Component Transformation Matrix		
	Component			Component		Component	1	2
	1	2		1	2			
P1	.758	-.085	P1	-.630	.430	1	-.758	.652
P2	.569	.644	P2	-.012	.859	2	.652	.758
P3	.545	.480	P3	-.100	.719			
P4	-.494	.579	P4	.752	.117			
P5	-.680	.408	P5	.782	-.135			

Extraction method:

- principal component analysis
- 2 components extracted.

Extraction method: principal component analysis.

- rotation method: varimax with kaiser normalization.^a
- rotation converged in 3 iterations.

Extraction method:

- principal component analysis.
- rotation method: varimax with kaiser normalization.

Based on table 3 of the matrix, rotation of the matrix, and the transformation of the matrix, then from the five (5) studied variables could reduce to only two factors. Factors formed factor 1: consists of a variable running task (P1), productive (P4) –and high motivation (P5). These factors are named factor ambition. How a group of students or learners eager to achieve something to succeed, more due to the ambition factor. Ambitions to succeed with motivation encouragement, run errands, and be demonstrated with productivity.

The P2 variable of patiently (P2) and focus on the details (P3). These factors are named the diligent work factor. This means a group of students or learners eager to accomplish something to succeed, more due to diligent factors. Diligent in fulfilling at patiently run the task and demonstrated with a focus on detail.

Early results found that the character was instrumental in the creation of a student of technology. The relationship between the creation student of technology could cause by the ambitious attitude and persistence of students. These two factors are critical to the quality of the creation of students of technology. In particular, the creation student of technology aims to increase the competency of original product design. Characteristics of character to strive as an ambitious shape facing industry era 4.0. Effectiveness characters form students ' identity, usually characterised by changes followed by creating readiness for achievement. The style runs the reflected task on behaviour and motivation work.

Education must instil high academic ambition in students, and parents must ensure their children take time to study [15]. In the mechanical engineering department Yogyakarta State University, the creation of a student of technology was an application of course theory of design. The students must complete the form of method in how product build and machine run. They must competent in drawing engineering, science and manufacturing processes. Hence the planting of productive characters must be able to work under the pressure and the highest quality. In industrial manufacturing, all parts must be precise and able to function. The timeliness of the limitation is one of the criteria of working on tasks.

Based on the factorial analysis, it could have concluded that students ' diligence contributes to the creation of students of technology. Alleged learning persistence contribution to student work is proven. The intervention in this connection plays an important role. The results of the Sule Alan Study showed that the response of the student character could last up to three years after treatment. Concerning diligence, sometimes intelligent students are defeated by the diligent and willing to work hard. Students who focus on details are thorough and able to produce excellent products [16].

4. Conclusion

The results of this research show that student characters influence the creation of a student of technology. The student must continually learn and implementation of new knowledge. Those found in the classroom or the real world. They also need to be able to adjust to new changes and the reality around them. The essential character early on must already be embedded in the students. Ambitious characters are one of the must-haves but must have based on an individual's innate abilities.

The result of a factor analysis finds two factors that affect satisfaction creation of a student of technology. These factors are ambition factors that include running task, productive, and high motivation, and diligent work factors that include patiently and focus on the details. The student, as a community element of hope, should prepare to reach future targets. They must observe, predict and try in the real world of work.

References

- [1] Clarcken R H 2010 *Considering Moral Intelligence as Part of a Holistic Education* (Denver: American Educational Research Association)
- [2] Slamet P H 2013 *Pengembangan pendidikan vokasi model untuk masa depan* (Yoyakarta: Cakrawala Pendidikan)

- [3] CCR 2015 *Character Education for the 21st Century: What Should Students Learn?* (Boston: CCR)
- [4] Sudrajat A 2011 *Mengapa pendidikan karakter* (Yogyakarta: UNY Press)
- [5] McIlrath L and Labhrainn I M 2007 *Higher education and civic engagement: international perspectives* (Chippenham: Antony Rowe Ltd)
- [6] Formia E M 2012 *Innovation In Design Education Theory, research and processes to and from a Latin perspective* (Torino: Umberto Allemandi & C)
- [7] Green W S and Jordan P W 2002 *Pleasure with products: beyond usability* (London: Taylor & Francis)
- [8] Hana U 2013 *The Journal of Competitiveness* **5** p 82
- [9] Dyer J, Jeffrey H, Gregersen H , and Christensen C M 2009 *The innovator's DNA: mastering the five skills of disruptive innovators* (Boston: Harvard Business School Publishing)
- [10] Dewey J 1938 *Experience and Education* (New York: Macmillan Company)
- [11] Bovill C, Cook-Sather A, and Felten P 2011 *International Journal for Academic Development* **16** p 133
- [12] Tomlinson C A and Allan S D 2000 *Leadership for Differentiating Schools and Classrooms* (Alexandria: Virginia)
- [13] Sudjana 2000 *Strategi Pembelajaran* (Bandung: Falah Production)
- [14] Santoso S 2017 *Statistik Multivariat dengan SPSS* (Jakarta: PT Elex Media Komputindo)
- [15] Ampofo E T and Osei-Owusu B 2015 *International Journal of Academic Research and Reflection* **3** p 19
- [16] Alan S and Ertac S 2018 *Journal of Political Economy* **5** p 126