日本における技術教育の評価 （英文）

Evaluation of Technology Education in Japan

Viewpoint of Socio-economic and Technology Literacy Eeducation

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I Introduction

In evaluating of Technology Education, we should deliberate on both socio-economic and individual aspects. From the socio-economic view point, policy makers and educators should consider the matching between education and employment:Technical Education for Life-long Human Development in a Changing Industrial Society.

Another viewpoint that concerns technology education is how students can satisfy their interests and aspiration, comprehend fundamental knowledge, and improve manual skills and problem solving skills effectively.

In order to evaluate technology education, the author carried statistical investigations used result of Ministry of Education, Science, and Culture (MESC) research, and introduced Japanese ways of evaluating of technology education with regard to the Course of Study, teaching schedule and teaching methodology.

II Evaluation from the socio-economic view point

The report of Organization for Economic Cooperation and Development (OECD) on technology education discussed the following problems:

(1) Breaking down barriers; the interface at the secondary level between general, vocational and technical forms; the interface between Technology Education (TE) and higher education, the possibility of transition to a polytechnic type of higher education. (2) Integration of initial approach, (3) Multilevel training stream (4) Non-conflicting approach (5) Contradictory aims; individual expectation and socio-economic requirement (6) Finding balance between general and vocational technical education and factors out side TE.

Concerning human power development, education / training and transition from school to work have been among the key political measures among OECD member countries and Asian Non-member Dynamic Economic e.g. four dragons(NMDE) countries. The structural adjustment and globalization of economy, which often bring about unemployment on a large scale, have called for newsocio-economic political measures and educational reform.

(1) Evaluations by outside observers and actual conditions

In recent years, observers in other coun-

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tries have given some high evaluations to the Japanese system of education, by reason of Japanese economic development and low dropout rate in spite of high rate of students' enrollment in secondary education. However, the majority of Japanese give a low rating to the system and point out a number of problems to be solved. There is a recognition that various trends in school education have become serious problems to be dealt with immediately. These problems include juvenile deliquency; violence and mental cruelty in schools; intensified competetion among pupils for entrance examinations to prestigious upper secondary schools and universities; the practice of selecting candidates for higher education almost entirely on the basis of the deviation value of students' written test; and the overall emphasis on educational background in society.

After compulsory education, 96.5% enter upper secondary schools, (*Koutogakko* 1994). Of those who enter the upper secondary schools, about 2% (about 100 thousand) drop out before graduating. After upper secondary education, 36.1% enter a college / university, 16.6% enter college level courses (*sennmonnkatei*) in special training school (*Sensyu-gakko*), and 27.7% go to work. However, 6.4% cannot find jobs and 13.2% enroll in miscellaneous schools. Table 1 shows the historical trend in percentage of enrollment in each education level.

Human power development in post war Japan has been promoted steadily. For this promotion there form of the education system in the immediate post-war years was the starting point. It has contributed greatly to the nation's subsequent economic and social development. Japan has one of the highest literacy rates in the world, and it is common to overlook the dramatic increase in educational achievement since World War II. After the war reforms, young Japanese entered the workforce with a much higher level of formal education than ever before. As a result, the current Japanese work force is a mixture of older workers with relatively lower levels of formal education and younger workers with higher levels of formal education. School education has focused on preemployment education for young people, while leaving the development of vocational capabilities to On-the-Job Training (OJT).

(2) Students Market and New Employees Market

In the Japanese educational systems, there have beeen two main streams provided for upper secondary level students, and a dichotomy between academic orientation and

Table 1 Historical Trend in Percentage of Enrollment in each education level

	1895	1905	1915	1925	1935	1947	1955	1965	1975	1980	1985	1990	1995
Pri. Edu.	61.2	95.6	98.5	99.4	99.6	99.8	99.8	99.8	99.9	99.9	99.9	99.9	99.9
Sec. Edu.	1.1	4.3	19.9	32.3	39.7	61.7	78.0	82.7	95.3	96.5	96.3	96.1	96.8
High. Edu*	0.3	0.9	1.0	2.5	3.0	5.8	8.8	14.6	30.3	33.5	32.1	32.2	39.0

* Does not include special training schools.

vocational technical orientation in education and training. This two stream system is in need of reform. Table 2 shows trends in student composition by the type of course. During the economic reconstruction era and the high economic growth era, enrollment in the vocational technical stream remained at about 40%.

An entrance examination to upper secondary school in public education has been implemented by the board of education in each prefecture. Generally speaking, the selection of students depends on a written test of academic subjects and a report on the pupil's record from their lower secondary school. Regarding entrance examination to higher education institutions; in 1979, MESC introduced the National Common University Entrance Examination as the first stage selection. At the second stage, each university selects by a written test of academic subjects. Students of lower secondary schools compete to enter upper secondary schools whose students have good results on university entrance examinations. Upper secondary school students also compete to get accepted to several universities which have good reputations among large prestigious companies.

In Japan, the prevailing employment practice is for all companises to hire new school graduates simultaneously as of April 1 every year. In the late 1960s, this practice was institutionalized as "extended-area employment service", when the Employment Security Law was partially amended. Article 25-2 and 25-3 of the Employment Security Law prescribed cooperation between with schools and the public employment security offices. Article 33-2 of the Employment Security Law states that secondary school principals can play a role in excuting the duties of the Public Employment Security Office. Recruitors of companies ask principals to recommend students as canditates for new employment. As a result, this system has been working as a nationwide new employees labour market for large-sized prestigious companies.

The national standardization of education has contributed greatly to the formation of a single integrated labour market for

Table 2 Trends in Student Composition by Type of Course. (%)

	% of upper sec. sch. enrolment	general	vocational	other
1955	79.0	59.8	40.1	0.1
1965	92.7	59.5	40.3	0.2
1975	95.3	63.0	36.3	0.7
1985	96.5	72.1	27.1	0.8
1995	96.8	74.9	23.5	1.6

primary and secondary school graduates in Japan. Such standardization has been attained due largely to the fact that compilation of teaching subjects and contents of textbooks for primary and secondary education have been unified on a national scale by such means as the MESC's guidelines "Course of Study" and "Texbook Examination and Authorization System". Foregin observers have often recognized " Meritocratic screening" in the Japanese educational system. The author summarized this situation in his "A tentative model of the Japanese Student Market and New Employee Market". (Figure 1)

Until the 1960's nearly half of the new employees were employed after completion only of lower secondary schools. After the 1970s most new employees have been graduates of upper secondary schools. New employees are composed mainly of two groups. One group is composed of general course graduates who will not or cannot advance into higher educational institutions. The other group is composed of vocational course graduates. Regarding the curricula of vocational technical courses, the MESC has been paying attention to the reform of the learning contents and methodology in accordance with social change. However, most of the general course graduates did not learn vocational technical subjects.

Actually the the number of general course graduates seeking employment is larger than the number of business related course graduates or industry related course

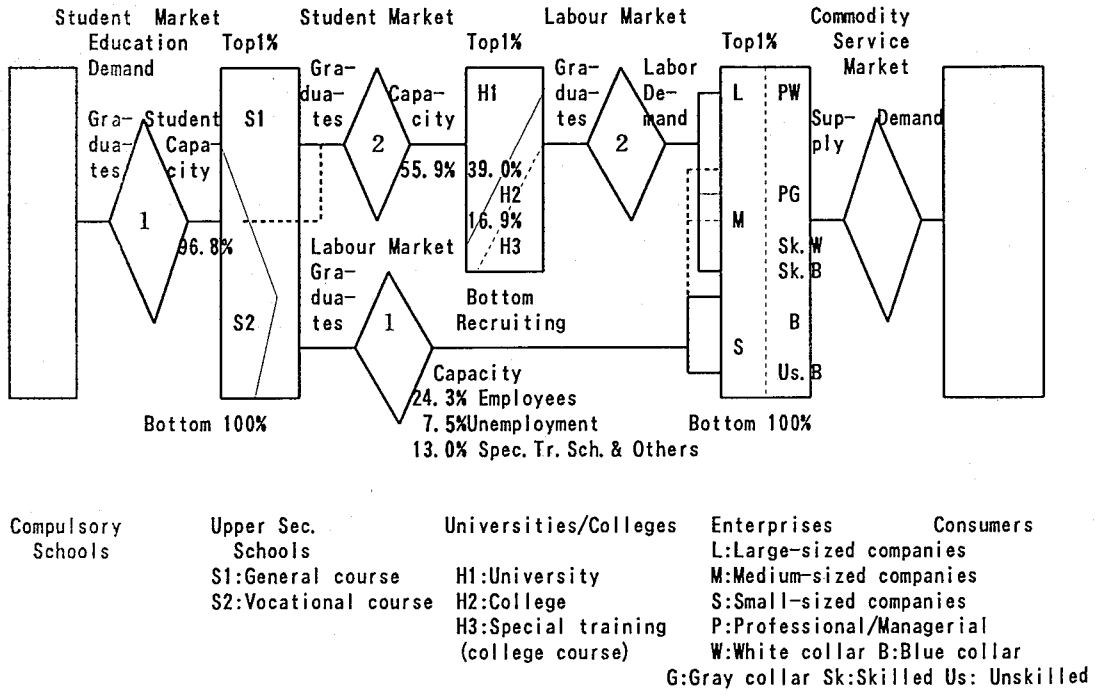

Figure 1　A Tentative Model of Japanese Student Market and New Employee Market (S, Murata 1995)

Table 3 Pathways of upper secondary school graduates by course (1995)

	Total	General	Agricul.	Industry.	Business.	Fishery.	Home Ec.	Nursing.	Others
University	39.0	46.9	7.2	9.2	14.2	10.0	17.6	35.2	58.9
Employment	24.3	13.6	64.6	66.7	55.4	73.4	47.9	14.3	9.8
Special Train.	29.9	32.3	23.3	19.5	23.2	13.4	25.9	47.9	23.9
Others	6.8	7.2	4.9	4.6	7.2	3.2	8.6	2.6	7.6
Total number	1,554,553.	1,163,321.	41,598.	131,605.	149,311.	4,008.	30,601.	7,484.	26,057
%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 4 Occupational Distributon of Upper Secondary School Graduates by Course

Division	1990			1994		
	Total	General	Vocational	Total	General	Vocational
Total (actual number)	622, 330	291, 946	330, 384	459, 280	200, 292	258, 988
Percentage	100%	100%	100%	100%	100%	100%
Professional & Technical	4. 1	2. 0	6. 1	4. 5	2. 5%	6. 5
Clerical Work	28. 2	29. 2	27. 3	21. 2 −	20. 0	22. 1
Sales Work	17. 0	20. 8	13. 7	16. 5	20. 4	13. 4
Service Work	11. 3	13. 9	8. 9	14. 9 +	18. 6	12. 0
Security Work	2. 1	2. 6	1. 6	2. 6	3. 4	1. 9
Transport & Communication	1. 7	2. 0	1. 4	2. 4	2. 9	1. 9
Production Process Work	34. 0	27. 6	39. 6	35. 9 +	30. 0	40. 4
Others	1. 2	1. 9	1. 4	2. 0	2. 2	1. 8

graduates seeking employment. (general: 152 thousand, business: 87 thousand, industry: 87 thousand in 1995)

From the view point of preparing youth for work, Japanese upper secondary education has the following problems: (1) general courses are regarded as more important, while vocational courses have been thought of as less important since the 1970s, with the result that vocational education has not been sufficiently strengthened; (2) upper secondary school education has been strongly oriented toward the preparation of students for entrance into higher educational institutions (universities/colleges). The third universal and self selective "Integrated Course(*sogogakka*)" was established in 1994 for the purpose of the compensating for VOTEC (Vocational Technical Education) illiteracy in general course students and enhancing Parity of Esteem between General and Vocational Education. This new type of course included not only general subjects, vocational ubjects,

Table 5 Employers' attitudes to graduates of high schools (1994.)
(Technical High School)

	male	female
Q. What was main reason for recruiting from THS ?		
1 Expected specialist knowledge and skills	79.5%	52.0%
2 Expected that THS graduates would have excellent attitudes, in terms of willingness to work in personal relationship	6.3	20.9
3 The fact that recruits were THS graduates was not a positive reason	9.2	14.2
4 Other	3.2	7.0
No answer	1.8	6.0

Q. What level graduates does your company want to employ ?	
1 University graduated specialists	43.0%
2 Technical High School (THS) garduated practical technician	35.0
3 Technical College graduated middle class technician	13.4
4 Others	5.2
No answer	3.3

Q. In the event that your establishment recuruits high school graduates in future, which, between THS graduates General High School (GHS) graduates, would you prefer?

	male	female
THS graduates	65.2%	8.8%
GHS graduates	3.4	20.7
Either	21.4	31.2
Other	8.0	11.7
No answer	2.1	27.6

Q If THS graduates would recruit in futur, what kinds of education should be stressed ?

	male	female
Specialist knowledge and skills	50.1%	15.5%
Liberal arts such as language, math,	5.2	5.1
Better attitudes to work	33.4	27.2
Other	2.7	4.4
No answer	8.6	47.8

Q If advanced 2 year course for THS graduates would establish, does your company want to employ ?

	male		female	
Positively to recruit	15.4	68.4%	4.7%	33.7%
If possible to recruit	24.2		10.4	
May to recruit	28.8		18.6	
Either	23.3		23.4	
Do not recruit	3.5		7.8	
Other	4.7		35.2	

Source: MESSC 1994

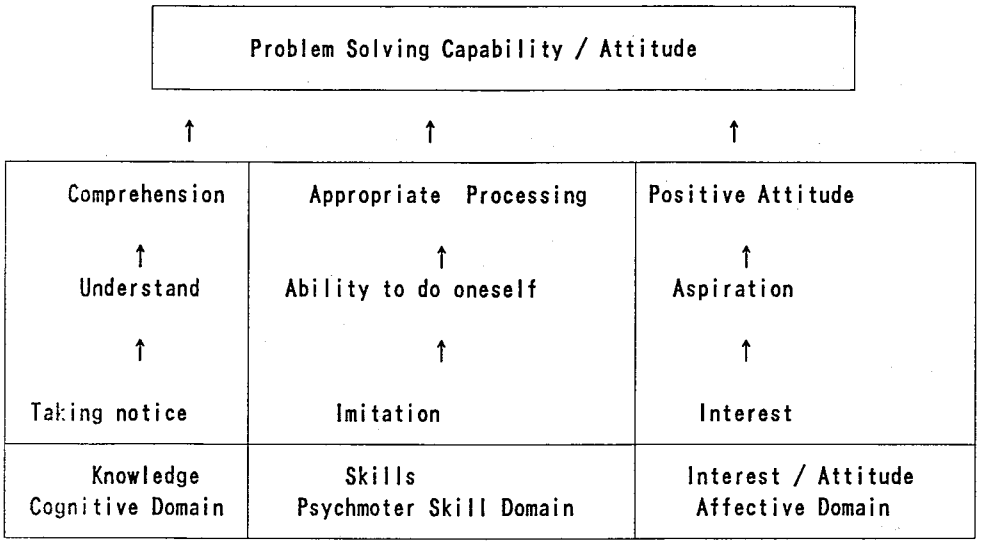

Fig 3 Structure of capability in technology literacy. (MURATA. S 1985)

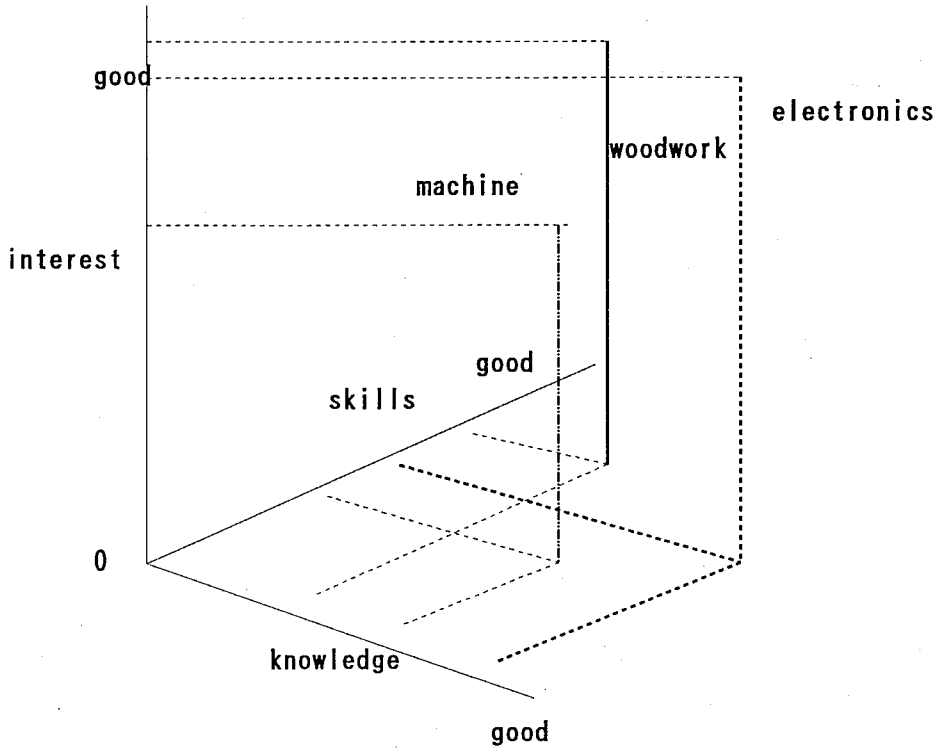

Figure 4 Relationship between knowledge, skill and interest in technology education

Table 6　The relationship between creativity and fundamental knowledge in electronics classes.
A : excellent, B : satisfactry, C : poor

Figures in table represent numbers of students in each category

creativity / knowledge		Ability to design a circuit in order to achieve specified objectives A	B	C	
Types and characteristics of electric power	A	6	16	3	
	B	2	28	10	
	C	0	1	1	
cicuit composition electric power, load, switch etc	A	6	27	4	
	B	2	12	5	
	C	0	5	6	
Ability to use electric measuring instruments to diagnose problems in an circuit	A	6	28	4	
	B	2	17	8	
	C	0	0	0	Total
Total Sub total	A	18 (9%)	71 (35. 3%)	11 (5. 5%)	49. 8%
	B	6 (3%)	57 (28. 3%)	23 (11. 4%)	42. 7%
	C	0	6 (3%)	7 (3. 5%)	6. 5%
Total		12. 0%	66. 6%	20. 4%	100. 0%

and vocational sub-courses but also fine arts, traditional craft, social welfare and so on.

Measures for vocationalization of general courses were intruduced in the 1980s, such as

(a) "Work experience activities" including explorative experiences and observation of work places,

(b) "Interfacing vocational technical courses", and

(c) "Reforming the entrance examination system"for universities.

(3) Improving the attractiveness of VOTEC

Concrning improving the attractiveness of VOTEC, education systems should keep the pathways open to advanced college level courses for vocational course graduates (*sen-kouka*), and higher institutions from secondary vocational courses, for example, the admission systems of university could be based on the recommendations of secondary school's principal (*suisen-nyugaku*), and the transition from school to work could be left open ended. These measures are indispensable to the improvement of the attractiveness of VOTEC.

The government and local board of education improve the attractiveness of Vocational Technical Education : introduced the following measures;

a, Improving facilities and equipment by government subsidization.

b, Retraining of teacters / instructors and invitation of experienced teaching staff from industries (*gaibu kousi*).

c, Image change: changing the name of the school from " Vocational High School" (*syokugyoukou kou*) to" Specialized High School" (*sennmonn-koukou*).

d, Encouragement of students to get vocational certifications.

e, Emphasis on career guidance in lower secondary school such as one day schooling experience (*taikenn-nyugaku*) in upper secondary vocational schools / integrated course.

In order to have well educated / trained, polyvalent / multi-skilled and flexible workers, we have to deliberate contents and methoology in VOTEC. What are the common core contents, common issues and issues specific to each member country in VOTEC? How should the methodology in VOTEC be improved?

In recent years, in line with the progress of technological innovation centering on the electronics sector, there has been rapid growth in knowledge-intensive sectors with in Japan's industrial structure. The service business sectors have also been under going continued expansion, whereas the influence of the service economy has also been on increasing in the structure of workers' employment and consumer spending, thereby prompting trend toward a soft oriented the national economy. Above all, Japan becomes an advanced information society, remarkable progress has been made in the information processing and telecomunications sectors. As a result of this progress, maney smaller and lower-priced office instruments, such as office computers and word processors, and industrial robots have been successfully introduced into offices and factories, thereby facilitating the trend toward office automation and factory automation. The advancement of research and development of new materials and biotechnology the new frontier technologies, are exerting an enormous impact on the real industry and economy.

(4) Systems of Education Reform and evaluation

In Japan, there are several councils for educational reform: the Central Council of Education deliberates general planning and central themes of Japanese education; the Council of Curricula discusses curriculum in

primary and secondary schools; the Council of Educator Training discusses teacher preparation; the Council on Industrial Education (which deliberates vocational technical education reform in response to technical and social change. The MESC consults with the Council of Curriculum on curriculum reform and receives recommendations.

Concerning VOTEC, MESC also consults with the Council of Industrial Education. In line with the recommendation of the Council of Industrial Education, MESC has established several project teams and deliberated teaching contents and methodology, and has also designed concrete programmes.

About every 10 years, MESC reforms the curricula of the primary and secondary levels.

MESC investigated employers' attitude concerning secondary school graduates and the Council of Industry Education deliberated on the reform of industrial technical curricula. Table 5 shows employers' expectation for scondary school graduates. The employers' expectations are professional / specialized knowledge, skills and work attitude.

(5) Technical social change and curriculum reform

Especially as a result of technical innovation and expansion of service industries, and dealt with the issue of problem solving skills and flexibility. MESC introduced Information Processing related subjects for all vocational school students, Independent Project Study and interdisciplinary convergent subjets such as Mechatronics (mechanics+electronics), International Economy (Business+English),

III Evaluation of the Course of Study (national standard), Revision of Contents and improvementof Methodology

(1) Evaluation by achievement test

In the1960s and 1970s, MESC carrid out simultanerous nation wide achievement tests. Many prefectures' board of education stressed preparation for achievement tests. The Japan Teachers' Union opposed MESC and board of education on this issues, criticizing this cramming knowledge policy.

(2) Evaluation by experimental schools

Begining in the 1980s, the MESC designated experimental schools in which conditions were precisely controlled, and investigated results. The experimental schools established evaluating project teams, consisting of school teachers, teachers' consultants in board of education and college professors. The project teams make plan for evaluation from the view points of three domains: cognitive / knowledge, psychomoter skills / manipulative skills and affective / interest and attitude.

Several experimental schools carried out evaluations and sent the result of these to the MESC.

The Course of Study is revised every 10 years based on recommendations of the Council of Curriculum and the report of the experimental schools' evaluation of implementation. MESC analyses the reports in order to improve the contents of the Course of Study.

Many technology educators / technology teacher educators tried to define the concept of technology literacy.
David J. Pucel (1992) defined "Technology Literacy" as follow:
"Technology Literacy is the possesion of understandings of technology evolution and innovation, and the ability to apply tools, equipment, ideas, processes, and materials to the satisfactory solution of human need".

Concerning the evaluation of technology education in Japan, the author prepared a model of the"structure of capability in technology literacy of the secondary level" in 1985 as shown in the following figure 3.

As a result of the experimental schools' evaluation, the author found several important facts on technology education :
(1) psychomoter skills were closely related to knowledge and understanding
(2) Psychomoter skills were closely related to time allocation
(3) the affective domain (interets / attitude) was also closely related to understanding and manipulative skills.

We reached the conclusion that it was important to select fundamental knowledge and skills, to teach / learn minimum essentials intensively, and to gradually increase and integrate contents.

In the 1990s, MESC suggested new four viewpoints of evaluation: interest / attitude, life skills, creativity, and knowledge / understanding. In 1993 MESC compiled hand book for evaluation and in 1994 MESC designated experimental schools and also carried out investigations for evaluation.

An investigation of an experimental school showed that creativity is closely related to fundamental knowledge in electronics clsses, while in woodwork classes there is a closer relationship between creativity and fundamental skills. Table 6 shows the relationship between creativity and fundamental knowledge in electronics classes.

(3) Annual workshop on technology education as evaluation and feedback

An annual work shop on technology education as evaluation has been carried out in each prefecture. Each prefecture sends their representative to Tokyo. Representatives meet in Tokyo and point out problems in technology education. The MESC considers how to cope with problems. The aims of the work shops are to identify problems in implementing technology education and to find solution: the work shop has a role of feedback.

As an evaluation in general technology classes, the author adovocates that (1) in the beginning of class, the teacher should carry out a simple *remedial evaluation*,
(2) during instruction, teachers should implement a *formative evaluation* with checklist / observation /performance, and
(3) at the end of the module / unit teachers should accumulate the results of checklist / observation / performance and project / product and carry out a *summative evaluation.*

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