Develop of Innovation for Overall Successful Learning

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Abstract

Innovation has many forms and thus many ways of being acquired. Restricted by time and space, our aim here is limited to showing some of the ways to develop of innovation in learning. We suppose that certain skills are efficient in reaching this goal such as modeling, situation management, operational control, teamwork, appropriate orientation and that, in addition, certain personal or social factors like motivation also play a role. We try to provide a theoretical conceptual basis for designing guidelines for innovative learning and provide a foundation for its continued development. We believe that it is crucial to establish reference methods to strengthen the relationship between innovation and learning. This paper, which focuses on the theoretical and conceptual abilities to develop innovation in learning, describes the relevant elements of an overarching framework for these references by establishing the individually based abilities required for effective participation in innovative learning, and highlights those skills that are important for overall successful learning.
Keywords: skill, innovation, learning.

1. Introduction

Exploring the ways in which we can learn and advance in our study or project calls us to acquire new skills. These abilities appear as efficient methods for acquiring or developing innovation in learning. In another sense, innovation itself is a kind of ability which helps us to create new ways of solving our problems. The better we manage to eliminate problems and find solutions, the better we are able to learn and advance. Some skills can be learned or acquired by pragmatic methods and workplace training opportunities. In this article, we outline the skills considered to be practice-based that are generally helpful in increasing or supporting innovation in all forms and for all methods of learning.

2. Invention or innovation

Before of begin to present innovation as a method in learning we must stress briefly the difference between invention and innovation.

There are many definitions for innovation. In commerce innovation is an improvement of a product, service, process or their components, which bring a commercial success. In technology, innovation is a part of a process that started by invention. But it differs from an invention by its part of an application perspective. Innovation differs from invention in that innovation refers to the use of a better and novel idea or method, whereas invention refers more directly to the creation of the idea or method itself. If innovation refers to the notion of doing something different rather than doing the same thing better, in the same time it must lead to give best result. Innovation is the process that leads to the act of innovating. That means to try constantly to improve the existing method and solution. This is a change in the manner of thinking or doing in order to run a new solution. We attempt to use this next definition to show the role of innovation in learning.

Innovation, in this way, is the ‘’development’’ of new value through solutions that meet new needs, or ‘’adding’’ value to old methods, idea, solutions by providing new ways of learning. It is the catalyst to learn.

Innovation is thus a phase after invention. Here we are interested exclusively in innovation because in learning at university students must do what ask them to do. They are not really free to do every thing. They are encompassed between the fixed models. In the best case students have permission only to develop, add or exploit their existents data. But they can’t go far. Cohen and Levinthal [6] gave a solution. For them an individual must “also develop the firm’s ability to identify, assimilate, and exploit knowledge from the environment what we call a firm’s ‘learning’ or ‘absorptive’ capacity.” This individual can be a student. We aim to extend this solution to the student’s learning. To understand better what this solution is, in learning, we are going to insist on the notion of ‘’absorptive capacity”.

3. Innovation or Absorptive Capacity

To explain “Absorptive capacity’’ we refer to Wesley M. Cohen and Daniel A. Levinthal [7]. As they have noted, it gives a new perspective on learning. It is “a function of the firm’s prior knowledge. Absorptive capacity is the ability of a

firm to recognize the value of new, external information, assimilate it, and apply it." A student who has the absorptive ability will be able to recognize not only the new information that he/she needs but also he/she should be competent to find the relation between old and new information (assimilate). We come back to this ability later.

Thus innovation consists on "the discussion that focuses first on the cognitive basis for an individual's absorptive capacity including, in particular, prior related knowledge and diversity of background." [7] Therefore the cognition is the first step for this new perspective that leads to innovation.

A little farther, in 1903, Tarde [19] has defined the innovation-decision process as a series of steps. Inspired by him, absorptive capacity, as a perspective, can help us to draw five phases if we want to classify the process of successful learning.

Table1. The phases by step in successful learning

1. First knowledge
2. Forming an attitude
3. A decision to adopt or reject
4. Implementation and use of our knowledge
5. Confirmation of the decision by the evaluation (success)

The first four phases can be explained that "the development of absorptive capacity, and, in turn, innovative performance are history-or path-dependent and argue how lack of investment in an area or firm's learning early on may foreclose the future development" [7] of success capability in other years of study or even in professional life.

For a student the innovation consists of adaptation and implementation. This can refer to the phases three and four. Absorptive capacity is the base of innovation so it can refer to the phase one and two. And finally learning capacity which is our principal objective depends on the absorptive capacity and innovation. "Learning capabilities involve the development of the capacity to assimilate existing knowledge, while problem-solving skills represent a capacity to create new knowledge. They are not much different. Therefore creative capacity and absorptive capacity are similar."[7] Briefly learning capacity involves innovation.

In these four parts student must use his/her individual capacities and his/her background knowledge as the component of the process in successful learning. The step five proves student's success.

"The ability to exploit external knowledge is thus a critical component of innovative capabilities. We argue that the ability to evaluate and utilize outside knowledge is largely a function of the level of prior related knowledge. At the most elemental level, this prior knowledge includes basic skills. Thus prior related knowledge confers an ability to recognize the value of new information, assimilate, and apply it. These abilities collectively constitute what we call a firm's "absorptive capacity". [7] Thus we can resume that absorptive capacity is required to be innovative.

4. What is the main problem?

There is long time that the researchers have been occupied by the notion of methodology at university. The publication of the methodological manuals, in the 50s, that proposed to teach students the techniques of academic work prove that to improve the method of learning isn't a new need.
"The failure in the first academic year, the mutation profiles of young people entering university and structural reforms that have been undertaken leading researchers trying to understand the heterogeneity of the study conduct and to better describe the specificities of academic learning practices" [1].

A statistical report at the University of Burgundy shows the failure rate which was 37% in 2008-2009 rose to 41% in 2009-2010. In 2010-2011 it rose yet again to 52% [21]. These figures relate only to students who have failed in the first academic year. We believe that the discussion of innovation is a rescue for this problem. It may suggest to us a hypothetical solution.

5. Relationship between learning and innovation

For Cohen and Levinthal "innovation and learning are two faces of R & D. They suggest that "R&D not only generates new information, but also enhances the firm's ability to assimilate and exploit existing information." Then student must use his/her information (back ground knowledge) in order to create the new information. He/she searches between his/her existed knowledge, even capacities and try to develop them.

By this way, innovation and learning are twin concepts that are necessary to obtain success. Innovation is a kind of ability that can be innate or acquired. Even if we enjoy innate innovation, we need to develop it because it is a very living ability. To acquire or develop this ability we first need a basis of information. This aspect of innovation can be learned as practice-based. The second step is information processing. Before this process, we need to recognize the necessary information in each domain. For all education planning, the basic knowledge and the relative factors need to be defined. This definition will then be used by the student to efficiently guide him/her through the

problem situation. This is the basis of good innovation that can be learned. Many factors contribute to the development of positive innovation. '' Successful educators focus on the intellectual and often ethical, emotional and artistic strengths and development of students." [4] We also recall the dependence of personal and social characteristics on this development. The role of intelligence and environment are two important factors of these characteristics. Personal and social factors can influence each other in the sense that environment may influence other important factors in innovation like motivation. "Motivational theory suggests that students and faculty (environment) alike will engage in tasks when they perceive such tasks to be of personal value and have an expectation of success, and that it is possible to create an environment in which people can motivate themselves. This environment must meet several criteria: provide positive reinforcement, convey enthusiasm, create awareness of value, maintain global awareness, cultivate personal responsibility, foster supportive interpersonal relationships, link an individual's intrinsic self-interest with the program, and structure experiences that show relevance."[4] An environment which covers all of these aspects provides a space for successful innovation because it includes motivational, social and experimental aspects, the most important factors for expressing innovation. All of these factors also influence the basic elements of innovation: knowledge and information. They therefore influence learning because knowledge and information are acquired by learning. "Adoption of innovation should be based on solid evidence of a positive influence on learning outcomes'' [4].

If we have an innate ability for innovation and if we successfully acquire the first step (information), the next steps (development) are guaranteed. But if we do not possess this innate tendency for innovation, we must learn/acquire it. Before determining the necessary information or abilities required for successful innovation, we need to know exactly who a good innovator is.

6. How we can be successful innovators?

Normally, we understand the term of innovation to mean creating a new way to solve a problem or finding this solution in a way which is not like what we are generally used to doing. ''An innovation presents people with alternative tools and ways of completing everyday tasks and solving a variety of problems in ways not possible without the innovation.''[17] In learning, innovation can help the student find an appropriate answer to their problems in general or in a specific case. Note that the student is not a machine built to produce something without thinking. So he/she must sometimes do things that are out of the ordinary. Good instructional innovation promotes better learning outcomes. She/he needs to learn certain methods. "The work of Cheetham and Chivers also found out extra occupational transfer, stretching activities and perspective switching as learning methods"[5] and thus able to help the student as a structure of innovation. In 2009, some of these structures were categorized as practice-based by Robert A. Blouin et al. [4] in the context of research on the roles of innovation in education in the pharmaceutical domain.

Table 2. Chickering and Gamson's Seven Principales of Good Practice, [4]

Good Practice:
(1) encourages contact among students and faculty.
(2) develops reciprocity and cooperation among students.
(3) uses active learning techniques.
(4) gives prompt feedback.
(5) emphasizes time on task.
(6) communicates high expectations.
(7) respects diverse talents and ways of learning.

These seven principles of practice are very general advice in learning. Innovation may result from these practices, but if we know how to use them they are more efficient. Learning as well as innovation takes many paths. We can learn to take these various paths. "In addition to formal education, learning can happen in practice and in repetitive situations but also in reflection. Observation, copying and feedback are also ways of learning." [5]

In the process of the acquisition or development of innovation, we have, on the one hand, our input (information and knowledge) which must be processed to obtain, on the other hand, our output (this is innovation). These seven principles can be used as guidelines for processing in the student's black box (Figure 1). The result of what occurs in the black box is our output or innovation. This innovation can be used as feedback concerning the result or in other problem situations as input to foster more fully developed innovation. It thus influences our future input in future problem situations. Indeed, this is a circular process: when we dispose of knowledge as input we obtain innovation as output. This output will be used as input to acquire more advanced innovation as well as to verify this operation.

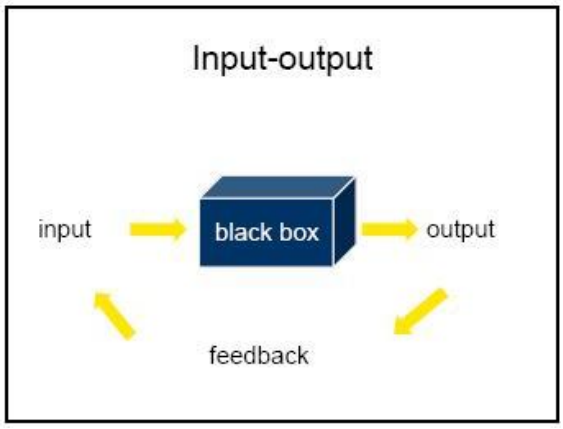

Figure1. Information processing

This model can be used in all situations of problem solving; only the ‘’input’’ element may be different according to specific objectives but as the summarizer’s process of the black box we can give some skills. ‘’ Indeed, rather than thinking in terms of teaching a discrete discipline, the students must be able to understand, apply, analyze, synthesize, and evaluate evidence and conclusions.’’ [4] As a conclusion to all this, we suggest some examples of skills linked to innovation in learning which can serve as the basis for some rules and define how we can use the principal practices in order to develop innovation. In other words, we would like to introduce here the methods which help us to execute the process happening in the black box. These methods are in effect some skills. Rather it can be a package of skills. While something novel is often described as an innovation, in economics, management science and other fields of practice and analysis it is generally considered a *process* that brings together various novel ideas in a way that they have an impact on the final result and in the science of education in final grade students.

7. Skill of modeling

What we mean by modeling is the assimilation of problematic situations. This implies finding or creating a relationship between two situations. This ability helps us increase the student’s power to act in a problem situation. Exploiting similarities between situations and using similar approaches in diverse and multiple contexts, disciplinary or interdisciplinary, especially if invited to conceptualize procedures implemented, help student to undoubtedly increase his/her power to act upon the world. [2]

In this way, the ability to " model" is a key in problem situations. For a definition of the conception of modeling we refer to the work of Balacheff, (2001) cited by Renaudie [15]. According to these authors, modeling (C) is a *quadruplet* concept (P, R, L, ∑)

- P : all of the problems

P is all problems that the conception C allows to solve.

- R : all of the operations

R is all operations which help us to transform a problem into another problem situation.

- L : language of representation

L is the language of description in which P, R and ∑ are described.

- ∑ **:** verification structure

∑ is a mechanism to determine whether the problem is resolved, and also contains elements of strategy guiding the student's choice. [15]

We can therefore formulate the whole as follows:

$$C= \{P, R, L, \sum\}$$

In modeling, the key is to be able to consider all the problems (P), and then consider a set of operations. In order to apply these operations, we need language (written or oral), and finally we need to verify all these steps to decide whether or not the problem has been solved, a step which also contains elements of strategy guiding the student's choice. In her doctoral thesis, Renaudie [15] defines modeling as a *quadruplet concept*. When an innovative student encounters problems (P) he/she must recall all operations and abilities which he/she is able to transfer from his/her experiences or information already acquired in order to apply them to the new problem situation. For Coquidé and Marshal [9] it is a "kind of experience, intellectual or theoretical tool of analysis or intermediary between theory and experiment and source of information (Parrochia, 2000; Varenne, 2006).’’ He/she requires a broad perspective which allows him/her to see all problems which can be considered in the same range (finding the assimilate cases) and for which the same operations can be used to solve different problems. When he/she has accomplished this step, a verification or management of the process represents the final step. If all four of these steps are completed, innovation occurs.

7.1. Skill of managing a situation

This skill serves especially in the development of innovation. Management of the problem situation in which the student may find him/herself is an ability which is critical to the success of the endeavor. This ability implies a range of complementary knowledge and skills such as the selection, combination and transfer of knowledge. As defined by Robert A. Blouin [4], it is, in effect,

to understand, apply, analyze, synthesize, and evaluate evidence and conclusions. We must understand the problem then select the information to apply and analyze the situation of this operation to evaluate the result (our output). Thus this ability is a package of knowledge that provides the methods to manage the situation or innate problem. Moreover, it necessarily depends on abilities mentioned above. "Articulation, collaboration and liaison that are also important methods of learning" [5] can be useful in the management of the situation. Finding the point of articulation between the current and other problems, as well as with other knowledge, collaborating them and finally establishing a strong liaison can increase the rate of innovation. This is because increasing one's ability to manage situations also increases one's scope of independent action. This ability is a very important part of modeling.

7.2. Skill of verifying the operation

One reason that we have chosen to highlight the skill to "verify the operation" is that innovation is by nature variable. This characteristic results in the need for a well-verified operation. Innovation as a skill is unstable because it is not available once and for all, but shifts shape depending on the situation and depending on the purpose. [15] The former can be the result of that the latter: "there is no single answer to a relevant professional imperative or only one way to solve a problem". [15]

As problems vary, so do the appropriated abilities required to solve them. This unstable nature is highlighted especially when it is a question of a particular area that requires a specific skill. So this verification step is needed to be able to innovate in every situation and to determine whether the problem has been resolved in the new situation (current situation). This skill is the fifth phase in table 1.

8. Skill of working independently

Independency is a personal characteristic that is required to be innovative. This personal characteristic can be highlighted in the high school by some methods in teaching or learning. After high school, the new student, entering into university, has probably acquired some methods that aren't efficient in university. One of them can be the dependency on the teacher or on their classmates for learning.

Innovation is a kind of challenge. As Suleman and Paul phrased it: "to meet the new problems challengers must be independent." [18] This challenge is more important for a yang first year student who probably has more dependency than a student in second year or a bachelor. This challenge should lead student to the development of any personal aspect such as independency.

"In principle, development takes place over time through continuing interactions between an individual and their surrounding socialcultural contexts. Both the individual and their cultural context are theorized to undergo change. Development is assumed to occur continuously as individuals constantly construct and reconstruct their response to a constantly changing collective culture"[16]. But why this skill can endow with innovation?

For Robert A. Blouin et al. [4], independency is to "respect diverse talent and ways of learning." By respecting the individual's talent, we enable them to present their ideas and we allow them to be themselves by increasing their self-esteem. This ability implies creativity. It gives us the opportunity to create our solutions and to implement our perspective. In terms of this skill, Legendre proposed to "put student activity as the center of learning, because it refers to the individual and his/her skills, and to include this activity in more open situations, let's create more opportunity for initiative and creativity of the subject in context, since the school work itself cannot be reduced to a simple implementation of what is required." [11] This ability complements and completes the capacity to model and to verify operations.

9. Teamwork

The student must know how to integrate a team and work with and among others. This is a constitutional element of innovation and according to Paivandi and Coulon [13], thanks to this ability we are able to develop learning methods: "According to W. Perry, the intellectual constructions of students do not just happen, the student should not be alone, and he/she needs to learn interactions. Educational situations can be involved in intellectual maturity, and intellectual support and student's encouragement contribute to developing an open and plural mode of learning." [13]. Robert A. Blouin et al. [4] defined teamwork as the principal practice of developing reciprocity and cooperation among students.

The ability to work in a team is a kind of affiliation that allows the student to integrate the system, know and then adapt to the new situation and effect positive creation. "For more fragile students", the lack of interpersonal communication helps to lead them to the exit." [13]

Teamwork contains the social aspect of learning and innovation. This is collective learning which allows us not only to learn and have access to other models, but also to share knowledge. When students communicate with each other, they share their knowledge, enabling new ideas to immerge by means of the different angles of vision.

The positive aspect of this ability is also mentioned by Tremblay et al. [20], citing the notion of knowledge exchange and working as a team. They maintain that this exchange is affected by sending and receiving information mutually. The process of information sharing includes all organizational practices used to disseminate (top-down) and receive (bottom-up) information.

This knowledge may bring with it disadvantages or be inappropriate. It may develop the style of acquisition described by Deslauriers and Hurtubise [3]: "practitioners develop a style of knowledge acquisition similar to the self-taught." (Auto-learner). But there is a risk that this knowledge may cause a feeling of pressure when the student works in a non-homogeneous group. [3] To create stress is an obstacle to innovation as well as learning. But the benefits of this knowledge are greater than its disadvantages. Teamwork helps the student use the knowledge of others as a model and then to adapt it to his/her situation or problem. The student can then invent his/her model. This skill can have a complementary effect in the interaction with the modeling ability.

10. Skill of constructing an orientation and to be engaged in a project

The term project as used here may have a very broad sense. It may range from constructing an orientation for a large life project to choosing the orientation in a problem situation. It is a choice between different plans of action reflecting the consequences that they may have for standards/norms and individual and collective goals (DeSeCo).[1]

However, this is production by means of contextualization-recontextualization (Morlaix, [12], Perrenoud, [14]). To attain this goal, it is necessary that the knowledge taught and learned be re-constructed and given a new orientation. "To this contextualization should be added everything that we know about the construction of knowledge in terms of interaction, sociocognitive conflicts, meaning of work and content, didactic contract, cooperative and active methods."[14] This production allows the student to develop his/her innovation because in each recontextualization a new element is included. According to Côme et al. [8], it is a way to develop ability by mobilizing knowledge and skills. Mobilizing knowledge in a new context leads to opening up a new orientation. To accomplish this orientation, engagement is required. For practical innovation to occur, students need to feel engaged, to face a real problem important for them and to conceptualize abstractly. This engagement leads to participation and communication, then to sharing of the information. In the end, by means of the modeling concept, the student creates new ways of solving even their new concept. We must prepare the opportunity to construct this process that can help them to demonstrate their abilities and the power to act in the new situation. In so doing, we offer the chance to innovate. This changes the status of the student from "agent" to "actor". If this "agent" feels engaged, he/she starts to face problems in situations which make him an "actor ". It is a real experience. Then he/she can enter into the phase of ''author'' and now we can call him/her an innovator.

11. The application of this study

Above we mentioned that a very important part of the skill of ''modeling'' is to know how we must mange a given situation. And in order to effect this management, we identified some complementary skills. We suggest that if the students acquire the relevant skills, their final grade will be influenced. Consequently, the student's grade is proof of his/her innovation because these are the skills that are needed to increase innovation. So if we show the relationship, as well as the impact of these skills on their success we can conclude that the innovation played a part in their grades. To examine the skill of ''mange the situation'' in a real case, we analyzed a research effected by the IREDU (Institute of Research on Education) at the University of Burgundy for ANR (National Agency of Research). In this research, we questioned students in three different majors enrolled in their first academic year. Following our suggestion about the necessity of these skills for students to be innovative, we are asked them about the skills that we suggested as the complementary skills such as ''selecting'', ''combining'' and ''transferring''. We found the following results:

Students participated in this study answered some questions about their problems such as '' selecting'' the important ideas in their courses. This question aimed to show to us whether or not they have this skill. The answers showed that of the 918 students, 75.5% announced that they have no problem to select the important ideas in their courses. But when we analyzed the impact of this skill on their grades, we found that this variable had a significant impact on their marks in the first session but for the second session[2] we found it was no significant. This may indicate that this skill is acquired or improved over time. In the same context we asked them about transferring their

1.The program 'Definition and Selection of Competencies that aimed to increase interest in information about education outcomes and their effects together with a need for a common overarching conceptual frame of reference for identifying and analyzing key competencies.

2-In France, there is two time exams par year. First session is in January and second in May. A final exam, there is in September.

knowledge and when we saw the answers to this question: ''Do you have difficulty in making links with what you have already acquired?'' they surprised us with their answers. 88.6% of the students declared not experiencing this problem, so it follows that this variable is no significant on their final grades. Meanwhile, there is a difference between the first and second session including the skill ''selecting''. In order to test the skill ''combining'' we asked them about the kind of working methods they used. We suggested seven working methods[3]. The students who use only one way represent 7.9% of our number and those who use all of the methods or six of the seven represented a tiny proportion in this study. A majority of the students use two (19.1%) and even three methods (27.6%). (cf. table 3).

Table 3: The proportion of the methods used by the students

Number of the method used	Number	percentage	Valid percentage
0	10	0.8	1.1
1	94	7.9	10.2
2	227	19.1	24.7
3	329	27.6	35.8
4	180	15.1	19.6
5	58	4.9	6.3
6	17	1.4	1.9
7	3	0.3	0.3
Total	918	77.1	100.

This finding does not truly demonstrated that they know how to combine their skills or knowledge, but our results help us understand if our student subjects have the sense of this skill and whether or not their grades are better when they do. We can see that the combination of the methods is more significant than one on the grade in both exam sessions and more than 75% of the students used more than on method. But this method didn't have a significant impact on their marks in the first session but for the second session we found it was significant. That can mean that they combined more than before the methods because we find that the number of the students admitted is increased to 12% in second session and they were the ones who used more than three methods.

This investigation can show only a small part of a large population composed of first academic year university students. We presented here the hypothetical skills needed to increase or support the ability to innovate. The other skills can be of help in the individual manner that is needed to be innovative.

12. Conclusion

Innovation has links to mastering new contents and skills. Some of these skills are related to constructing a model of the problem, to being able work with others and to defining an objective and motivation. In another sense, it relates to environmental and individual factors. To increase the student's motivation "it is important to recognize individual preferences in learning and that learning environment must be designed with this in mind." [4] Innovation in learning can be varied as well as individual. To create innovation, mastering new content by means of basic information and knowledge is necessary but not sufficient; the student must be encouraged, engaged and oriented.

The process of innovation begins with basic information but is completed by certain practical abilities. Deslauriers and Hurtubise [10] explain how this happens:

"Once launched, in practice, the practitioner must be equipped by a kind of interior gyroscope allowing to direct through theories and intervention models launched on the market of knowledge over the years, it will also renew his/her practice to solve the new social problems that arise. Therefore, the practitioner must find in the basis of his/her professional training, the main guidelines allowing adapting and evolving."

This is how these abilities enable us to increase the quality of innovative learning. In the case of innovation in a project, there needs to be a decontextualization of knowledge already acquired in order to use it in another context. Thus the phenomenon of recontextualization plays a role in this situation.

In this way, students can apply the concept of project management and build their own *guidelines*. They are individuals who must be able to contribute their skills and knowledge to their operational structure and create meaning in a changing environment where life is often fragmented, as recognized in DeSeCo.

3- These seven methods are: 1-simple lecture of courses 2-search the vocabulary in the dictionary or on net. 3- Search more information. 4- To stress the words or the phrases of theirs notes 5- To make an abstract of the lesson. 6- To make a plan or a diagram. 7- To rewriting many times the courses.

Their (institutional) environment and educators can help them to be innovative by training them in certain guideline methods in the workplace adapted to their rhythm and their preferences. The more these students are armed with such abilities, the more independent they will be and the better able to find their own ways and their own solutions. In this way, we can be optimistic that students will learn, not like machines but like humans who use their ideas and preferences in such a way that they innovate new solutions to their problems.

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