

The Key Competencies in Informatics and ICT viewed from Nussbaum's Ten Central Capabilities

Toshinori Saito

Professional Program of School Education

Japan Professional School of Education

t-saito@kyoiku-u.jp

Abstract: This article shows a discussion about the key competencies in informatics and ICT viewed from a philosophical foundation presented by Martha Nussbaum, which is known as 'ten central capabilities'. Firstly, the outline of 'The Capability Approach', which has been presented by Amartya Sen and Nussbaum as a theoretical framework of assessing the state of social welfare, will be explained. Secondly, the body of Nussbaum's ten central capabilities and the reason for being applied as the basis of discussion will be shown. Thirdly, the relationship between the concept of 'capability' and 'competency' is to be discussed. After that, the author's assumption of the key competencies in informatics and ICT led from the examination of Nussbaum's ten capabilities will be presented.

Keywords: Capability approach, competency, teaching informatics in general education, philosophical foundation of informatics pedagogy, education and public policy

1 Introduction

'Key competencies in informatics and ICT' seems to be a topic which tends to be discussed in the context of technology and social change. It is actually natural because the topic has emerged with the recognition of the impact of social change brought by the proliferation of digital networking technologies. However, the author considers that the focus of the discussion should not be restricted within the context of technology and social change because the concept of 'competency' has also the strong link toward other contexts, such as pedagogy, philosophy, and public policy. The attempt with which the author has engaged

in this article is to build a ground of the discussion of the topic in terms of the universality of human well-being, come from the viewpoint of moral philosophy, which gives a starting point to consider current problems of informatics education and the educational use of ICT as subjects of public policies.

More specifically, this article attempts to show a discussion about the key competencies in informatics and ICT viewed from Martha Nussbaum's central capabilities. In this article we consider the following question: How should we delineate key competencies in informatics and ICT, which are acceptable from the viewpoint of social justice? The basis of the discussion is put upon the recognition that the execution of informatics and ICT education is a kind of the matter of public policy, which is necessarily grounded on a normative standard. Hence, we attempt to conduct the reasoning referring to The Capability Approach (CA), which is proposed by Amartya Sen and Martha Nussbaum, as a normative basis of public policies.

2 What is the Capability Approach?

The CA is a theoretical framework presented by Amartya Sen and Martha Nussbaum, which is intended to evaluate and assess the state of social welfare, namely, "individual well-being and social arrangements, the design of policies, and proposal about social change in society" (Robeyns, 2005, p. 94). This framework comprises two core terms, which are 'functionings' and 'capability'. The term 'functionings' is explained as that which "represent parts of the state of a person – in particular the various things that he or she manages to do or be in leading a life" (Sen, 1993, p. 31), such as "being happy, having self-respect, taking part in the life of the community, and so on" (Sen, 1992, p. 39). On the other hand, the term 'capability' is that which "reflects the alternative combinations of functionings the person can achieve" (Sen, 1993, p. 31). The CA is characterized by evaluating the equality of the enjoyment of "substantive freedom" (Sen, 1992, p. 49) to achieve functionings which a person thinks are valuable, whilst the utilitarian approach features merely the achievement of individual 'utility' which is defined in terms of some mental characteristics, such as pleasure, happiness, or desire, and ignores freedom and achievements which are other than those reflected in one of these mental metrics (ibid, p. 6).

3 What and why Nussbaum's ten Central Capabilities?

This article attempts to examine how the key competencies in informatics and ICT are illustrated from the viewpoint of 'ten central capabilities' (Figure 1) proposed by Nussbaum (Nussbaum, 2000, 2005, 2011b). 'Ten central capabilities' is a list of capabilities about which she argues are "fundamental entitlements inherent in the very idea of minimum social justice, or a life worthy of human dignity" (Nussbaum, 2011a, pp. 24–25). Though Sen denies to indicate or emphasize the importance of any specific capabilities positively in the CA, Nussbaum has presented a comprehensive view of indispensable capabilities as 'ten central capabilities', that she insists the government is responsible to ensure, which is based on "common humanity" (Nussbaum, 1993, p. 263) led from Aristotle's list of the sphere of the 'grounding experience' and virtues. This is because she believes the CA should have the potential of evaluating the achievement of creating just society, and for the purpose, "those human capabilities that can be convincingly argued to be of central importance in any human life" (Nussbaum, 2000, p. 75) have to be isolated.

The reason for applying 'ten central capabilities' as a viewpoint of illustrating the key competencies is that it is thought to be a reliable framework that leads justifiable objectives of public policies about human well-being which any just society should pursue. More precisely, we would point out three reasons that lead us to apply 'ten central capabilities'. Firstly, it is the framework which dares to bring the universal foundation upon the discussion of human well-being. Her notion of universalism, which comes from the interpretation of Aristotelian philosophy, is oriented toward cross-cultural consensus and to be distinguished from absolute view of culture and humanity in allowing pluralism and being open to necessary revisions (Nussbaum, 2000, p. 77). Secondly, it is presented essentially as a normative framework which intends to assess the moral basis of political issues. This shall give an obvious advantage for our attempt of seeking a moral basis and justifiable understanding of the key competencies which should be provided in terms of public policies. Thirdly, it is described clearly and explicitly, which enables it to be shared and discussed in public. We recognize that dealing with moral issues as a research topic is necessarily followed by the difficulty of proving its validity and has inevitable limitation in its result because the ultimate foundation of the research is always placed on intuitive judgement. Therefore it is crucial for our research to have an open and explicit theoretical ground which gives a starting point of our argument.

4 The Relationship between Competency and Capability

According to the preceding discussions, capability is understood as border in its scope of the meaning than competency. Stephenson (1998, p. 3) describes competency approach as “essentially a top-down control model which aims to secure the effective delivery of current services based on standards determined by past performance”, and in addition, he explains as below:

Capability is a broader concept than that of competence. Competence is primarily about the ability to perform effectively, concerned largely with the here and now. Capability embraces competence but is also forward-looking, concerned with the realization of potential (Stephenson, 1998, p. 3).

Otto and Ziegler (2006) have also referred to the relationship of both concepts in the context of education.

Thus the strength of the capability approach lies in its capacity to provide sensible tools and frameworks within which literacy, competences and other educational aspects might be appropriately conceptualised and evaluated (Otto, Ziegler, 2006, p. 270).

Based on the discussion above, in this article we shall adopt the presumption that the concept of competency is to be contained by the concept of capability. More precisely, we regard competency as a factor which belongs to humans, that supports realization of capabilities through ensuring some functionings and enabling humans to have alternatives to choose concerning one’s well-being. Another factor that would support realization of capabilities is assumed to be socio-cultural context, which affects human consciousness externally and prepares them to acquire some competencies through providing specific social and/or cultural preconditions. If the socio-cultural context allows a person to find and recognize the existence of the demand for a competency, and he/she actually succeeds in acquiring it, then we are able to tell that a functioning which supports a certain capability is prepared for being practiced.

1. **Life.** Being able to live to the end of a human life of normal length; not dying prematurely, or before one's life is so reduced as to be not worth living.
2. **Bodily Health.** Being able to have good health, including reproductive health; to be adequately nourished; to have adequate shelter.
3. **Bodily Integrity.** Being able to move freely from place to place; to be secure against violent assault, including sexual assault and domestic violence; having opportunities for sexual satisfaction and for choice in matters of reproduction.
4. **Senses, Imagination, and Thought.** Being able to use the senses, to imagine, think, and reason – and to do these things in a “truly human” way, a way informed and cultivated by an adequate education, including, but by no means limited to, literacy and basic mathematical and scientific training. Being able to use imagination and thought in connection with own choice, religious, literary, musically, and so fourth. Being able to use one's mind in ways protected by guarantees of freedom of expression with respect to both political and artistic speech, and freedom of religious exercise. Being able to have pleasurable experiences and to avoid nonbeneficial pain.
5. **Emotions.** Being able to have attachments to things and people outside ourselves; to love those who love and care for us, to grieve at their absence; in general, to love, to grieve, to experience longing, gratitude, and justified anger. Not having one's emotional development blighted by fear and anxiety. (Supporting this capability means supporting forms of human association that can be shown to be crucial in their development.)
6. **Practical Reason.** Being able to form a conception of the good and to engage in critical reflection about the planning of one's life. (This entails protection for the liberty of conscience and religious observance.)
7. **Affiliation. (A)** Being able to live with and toward others, to recognize and show concern for other human beings, to engage in various forms of social interaction; to be able to imagine the situation of another. (Protecting this capability means protecting institutions that constitute and nourish such forms of affiliation, and also protecting the freedom of assembly and political speech.) **(B)** Having the social bases of self-respect and nonhumiliation; being able to be treated as dignified being whose worth is equal to that of others. This entails provisions of nondiscrimination on the basis of race, sex, sexual orientation, ethnicity, caste, religion, national origin.
8. **Other Species.** Being able to live with concern for and in relation to animals, plants, and the world of nature.
9. **Play.** Being able to laugh, to play, to enjoy recreational activities.
10. **Control over One's Environment. (A) Political.** Being able to participate effectively in political choices that govern one's life; having the right of political participation, protections of free speech and association. **(B) Mental.** Being able to hold property (both land and movable goods), and having property rights on an equal basis with others; having the right to seek employment on an equal basis with others; having the freedom from unwarranted search and seizure. In work, being able to work as a human being, exercising practical reason and entering into meaningful relationships of mutual recognition with other workers.

Figure 1: Nussbaum's ten central capabilities (Nussbaum, 2011b, pp. 33–34)

5 Informatics and ICT Competencies viewed from the Central Capabilities

As a result of the discussions in this article, we shall present a summary of the assumption of the key competencies of informatics and ICT, which we found through the examination of Nussbaum's ten central capabilities. To acquire the summary, we examined each of the meanings of the ten capabilities in terms of the conditions indispensable for the achievement of each of the ten capabilities. Then we analysed those conditions and found out the possible informational factors, which were supposed to have a link with using information or the knowledge of informatics or ICT, which were thought to affect the formation of the conditions. Following that, we analyzed the detail of the informational factors and distinguished what was thought to belong to human competency from what was thought to belong to socio-cultural context. Then, we summarized the results about the human competencies which provides the basis of the informational conditions indispensable for the achievement of the ten capabilities and made eight descriptions listed below which represent the substance of the examination. The numbers within the parentheses after each of the sentences indicate the relating item(s) of the Nussbaum's ten capabilities.

1. **Accessing, collecting and understanding information.** Being able to access and collect the information about what helps improve quality of life and realize well-being: to understand and use available support known from the collected information. (1, 2, 3, 7, 8, 9, 10)
2. **Vision organizing.** Being able to organize a vision about human life and well-being based on the available information. (1, 2, 3, 6, 7, 8, 9, 10)
3. **Participation in communication.** Being able to participate in the communication which is concerned with the realization of well-being and, if necessary, to create a platform of communication with the available informational tools. (1, 2, 3, 5, 7, 8, 9, 10)
4. **Expansion of sense, imagination, and thought.** Being able to learn and expand the use of senses, imagination, thought, and reasoning using the help of informational environment: to express as and convert into information the fruit of the use of such abilities. (4)
5. **Relationship control with informational environment.** Being able to control the relation with informational environment in response to its influence upon one's emotion. (5)
6. **Application of informatics concepts toward practical reasoning.** Being able to use and apply the concepts of informatics as the basis

of practical reasoning, which is required by the nature of the informational environments consist of information and communication technologies. (6)

7. **Use of practical reasoning ability.** Being able to make the best use of the ability of practical reasoning helped by informational environment for the pursuit of conceptions of the good. (6)
8. **Management of property's information.** Being able to manage by self the information of one's own property assisted by informational environment. (10)

5.1 Accessing, collecting and understanding information

This competency is about the connection between the source of information and those who demand the information. In accordance with the listed capabilities (1, 2, 3, 7, 8, 9, 10) which give the ground for the competency, the instances of the information are assumed to be the following: the social conditions and the person's individual circumstances, the rights guaranteed by law, the social support services provided by the government or the other various formal/non-formal organizations, the procedure of political participation and the choices of the political groups to support, the circumstances of the labour market and the available support for job seeking, the basic knowledge about acquiring the goods and the properties indispensable for healthy and cultured human life.

This competency is intended to make the listed capabilities feasible in terms of improving the certainty of the receipt of information. The realization of the listed capabilities is thought to require two important conditions which are related to the receipt of information: firstly, people are able to have the idea of and the desire for well-being, secondly, the existence of the services which are relevant to the support of the realization of well-being is recognized by the targeted people. With regards to the former condition, the idea and the desire for well-being cannot be formed without any information about what human life is. For the latter condition, there would be no chance for the services to be used by the targeted people if the information about the existence of the services doesn't reach to them. In terms of the human competency, these are assumed to be the problems of the ability of accessing, collecting, and understanding information because these three factors are seem to be essential to ensure the certainty of the receipt of the information.

5.2 Vision organizing

This competency is about the conversion of information into visions of the future and we think this is what consists of the realization of the listed capabilities (1, 2, 3, 6, 7, 8, 9, 10) by providing the fundamentals of the desire for well-being. When we think of doing something for the sake of improving quality of life, there must be a vision, regardless of whether it is clear or not, about what a desirable life would be. If the vision is clear and long-term enough, it would well enlighten what and how we should engage in the improvement of the current quality of life. On the contrary, if we are merely allowed to have ambiguous and short-term visions, it would be quite difficult to figure out what the problem is in the current quality of life. If we are in the same condition about accessing and collecting needed information, one of the most influential factors which decides whether we could have a clear and long-term vision of well-being or not shall be the ability of interpreting the meaning of the information and forming an idea based on the acquired meaning. In terms of the informational competency, this ability is to be expanded as the capability of organizing a vision about well-being based on the available information.

5.3 Participation in communication

This competency expresses the fundamental condition which enables the social participation to maintain human quality of life. We think this competency directly links to the capability 7 (affiliation), and also has deep relationship with the other listed capabilities (1, 2, 3, 5, 8, 9, 10). The communication which is concerned with the realization of well-being may be understood quite broadly, such as communication concerning with daily life, culture and hobbies, jobs, political and economical issues, and so forth, all of which provide information that indicates explicitly or implicitly the state of individuals' and communities' well-being. This competency is crucial for the realization of the listed capabilities because of the following two reasons: Firstly, communication assisted by ICT (Information and Communication Technologies) is assumed to extend grounds for practical urging on society by individuals or groups for the sake of human quality of life: secondly, it is also to extend opportunity of individuals to acquire self-respect and human dignity through accepting consideration by others.

5.4 Expansion of sense, imagination, and thought

This competency indicates the importance of the potential to develop the basis of human intelligence and sensibility, making full use of the merits provided by given informational environment, which is assumed to be formed with available informational resources and the tools to use them. This competency gives an essential precondition for the capability 4 to be realized under the circumstance of digital informational environment, for we need to have the opportunity of learning and developing how to use our intelligence and sensibility in cooperation with the informational environment before we enjoy fully these abilities. In this context, informational environment shall take the role of providing directly the access to intellectual or cultural assets or systems of education, and also the role of providing the indirect information about how to access such assets or educations.

5.5 Relationship control with informational environment

This competency focuses on the power of mentality and intelligence to keep emotional autonomy from the influence of informational environment and is thought to have a strong link to the capability 5 through giving the ability of choose appropriately the distance with the informational environment. In the society where the use of digital network has become ordinary, the influence of informational environment upon human emotion is supposed to be crucial and unavoidable, so that control over the distance with informational environment would be essential to maintain good health of our emotion in the life of on-line and off-line.

5.6 Application of informatics concepts toward practical reasoning

This competency is about the concepts of informatics that would become indispensable knowledge to provide the basis of practical reasoning within the society where the use of digital informational environment has been diffused. 'Practical reasoning' is assumed to be the application of the reasoning ability toward practical problems which we encounter in daily life. On the other hand, the concepts of informatics, such as abstraction of data, algorithm construction, structuralization of knowledge, system analysis and integration, formalization and standardization of expression, and so on, are kinds of knowledge base which propose proper solutions for the problems of human and computer software. If we hope truly to have the capability of forming a conception of

the good and engaging in critical reflection about the planning of one's life, according to the description of the capability 6, we must have good command of changing and reorganizing given informational environment following the requests that come from the conception of the good we pursue and the critical reflection we are engaging in. Therefore the concepts of informatics would become the common basis of practical reasoning under the circumstance of digital information environment.

5.7 Use of practical reasoning ability

This competency features the actuality of realization of conceptions of the good by using the ability of practical reasoning. We assume that the capability 6 would be supported not only by the knowledge of the informatics concepts, which is argued as the competency 6, but also by the actual ability to execute reasoning helped by informational environment. The ability of reasoning is supposed to be various and not limited within the informatics concepts, however, if we hope to enjoy fully the merits of digital informational environment for our reasoning practice, it is obvious that learning the way of reasoning using the artefacts of computing, which is known and practiced as computational thinking, must be helpful.

5.8 Management of property's information

This competency is about the economic independency and autonomy which are enhanced by informational environment. This competency is related to the former part of the capability 10 – (B), which is concerned with holding property. We consider the competency is essential because the information of the status of the property which is owned by individual is getting to be computerized recently and much easier to be recognized, and such recognition is believed to allow the individual to make use of the property with a careful and long-term plan, which means the economic liberty possessed by the individual has been increased relatively.

6 Conclusion

In this article we have discussed the key competencies of informatics and ICT from the viewpoint of Nussbaum's ten central capabilities. As a result, we have found eight descriptions of the assumption of the key competencies, which are concerned with (1) accessing, collecting and understanding information, (2)

vision organizing, (3) participation in communication, (4) expansion of sense, imagination, and thought, (5) relationship control with informational environment, (6) application of informatics concepts toward practical reasoning, (7) use of practical reasoning ability, and (8) management of property's information. To draw the shown result, we have also examined the nature of Nussbaum's 'ten central capabilities', which is characterized by the connection toward Aristotelian philosophy and the standpoint of universalism, and the conceptual relationship between competency and capability.

The core motivation for us to engage in this research is to present a version of philosophical understanding of teaching informatics, and through this attempt, we hope to make clear the public and universal nature of teaching informatics as a genre of pedagogy. As we argued before (Saito, 2013), establishing the logic that justifies the position of teaching informatics as a public matter would be one of the keys to diffuse fair understanding of and share awareness with those outside the ICT-education-practitioner-communities about the indispensability of teaching informatics in general education, and this research has been conducted along such interest. We expect that the eight key competencies could be referred as a normative foundation of the purpose of teaching informatics in general education and the criteria which are used to assess and evaluate the achievement of it.

We recognize that the research still has some problems left to be solved. Firstly, the detail and the basis of the process of leading the eight key competencies from Nussbaum's ten capabilities are not shown sufficiently. To lead the eight competencies from the ten capabilities, we examined the general conditions which we thought were essential for the achievement of each of the capabilities, and then, we analyzed the relevance of the informational factors with those general conditions. Moreover, we distinguished the informational factors which we thought belong to human competency from those which belong to socio-cultural context. This process is based on the belief that the informational factors, which can be understood as combinations of the aspect of human competency and that of socio-cultural context, are necessarily to be crucial for the achievement of each of the ten capabilities. However, in this article we could not present clearly the discussion about the reason why we considered the belief to be proper and reliable as a basis of the reasoning process. Secondly, the examples which explain the application of each of the eight competencies to pedagogical occasions are also insufficient. Not until they are applied to indicating the purpose and the objectives of teaching informatics in general education would the presented eight key competencies be worthy of being referred as an instance of the knowledge which provides a version of

philosophical understanding of teaching informatics. We recognize that concrete examples would help making clear the pedagogical meaning of the eight key competencies and without examples, on the other hand, the contribution of the eight key competencies toward informatics pedagogy would remain quite limited. Both of the problems shown here are surely to be addressed continuously in our following researches.

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Biography



Toshinori Saito is an associate professor in the Professional Program of School Education at Japan Professional School of Education, also is a member of Information Processing Society of Japan, Japan Society for Educational Technology, Community for Innovation of Education and Learning through Computers and Communication Networks, and Asia-Pacific Media and Information Literacy Education Centre.

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