Disaster Triangle –A Conceptual Device for Implementing Comprehensive and Continuous Disaster Education into School Science –

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While “mechanical devices” such as seismometers are used to observe concrete physical phenomena, “conceptual devices” that construct mental images in brains are used to understand complex and ambiguous phenomena. For example, a conceptual device “disaster” would evoke eruptions in brains of volcanologists, and fires in brains of fire protection engineers. New academic disciplines are emerging, all of which are associated with disasters in some way. When individuals or society must make a decision from a wide perspective, it is becoming more and more difficult for each expert to give a perspective wider than his/her own field. We need to develop and share a cross-disciplinary conceptual device that will generalize various disasters and give us increased visibility, in order that humankind might overcome devastating disasters together. In the field of fire protection, the “fire triangle (fuel, oxygen, and heat)” has been playing the role of conceptual device for understanding complex fire phenomena. The author explained a disadvantage of the fire triangle that could not describe transitions between states (ignition or extinction) triggered by interactions among various agents, and suggested that the “self-organization”, a conceptual device of complex systems consisting of a number of agents with non-linear interactions, might make it possible for us to comprehensively understand both social and natural phenomena (Nomura, 2019).

All phenomena in the world of nature, including those in human society that is a part of the world of nature, are governed by interactions among three elements: “matter”; “energy”; and “motion”. By illustrating these three elements interacting with each other and naming the illustration the “disaster triangle”, the concept of disaster that tends to be minimized in everyday life could be evolved into a universal concept with which we could analyze various disaster processes based on system thinking, that is the focus of the present paper. For example, if a phreatic eruption is analyzed with the disaster triangle, it is depicted as a conversion process of internal energy of superheated water (matter) into kinetic energy driven by a change in boundary conditions. Then volcanologists would become aware of the risk of boilover in crude oil tank fires more easily. For another example, Kimura (2017) depicted a typhoon as an analogy of combustion. Within cumulonimbus clouds, internal energy of water vapor (matter) is released as condensation heat that is transferred to ambient air, gives buoyancy, and maintains updraft (motion). In the case of a fire, internal energy of combustible material (matter) is released as reaction heat during combustion that is transferred to ambient air, gives buoyancy, and causes the chimney effect. According to Kimura (2017), “cumulonimbus clouds are something like chimneys.”

It is expected that potential disasters that are ignored in everyday life might be noticed systematically, if the disaster triangle would become a widely shared conceptual device in society and enhance comprehensive understanding of natural, man-made, and complex disasters. In the present talk, possibilities of disaster education in school science utilizing the “disaster triangle” will be discussed.

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