

Constructivism and Tools of Integration

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Graphic organizers in a variety of forms are useful tools for curricular design, especially when designing integrated curricula. Rogers and Mack (1996) wrote about the benefits of using graphic organizers in general in the planning of constructivist curricula. Clayton et al. (2010) describe the use of curriculum mapping tables, a form of graphic organizer, for the purpose of aligning topics across subject disciplines as an essential early step in the planning of integrated curriculum units.

Allen et al. (1993) make a case for using concept maps specifically because they allow curriculum developers to create what they call “integrated curriculum knowledge maps”, which combine subject matter experts’ knowledge bases with instructional objectives to create a well-integrated curriculum (p. 8). Meanwhile, planning wheels, another type of graphic organizer that is useful for designing integrated curricula, can provide busy faculty a “flexible vehicle for addressing the need to “get started” making connections” between subjects in a given grade level (Palmer, 1991, p. 58). This paper will discuss the benefits of using concept maps and planning wheels in the design of integrated curriculum units and describe examples of how each can be used in the design of an integrated mathematics and design technology unit.

The benefits of concept mapping

In the process of designing an original integrated curriculum unit, Allen et al. (1993) distinguish between three types of maps, each of which represent different yet overlapping sets of information. Curriculum maps represent the content of a particular course of study in graphic organizer format, while content maps can be considered to represent the relationships between concepts and subtopics in a particular field of knowledge, as generally agreed on by experts

(Allen et al., 1993, p. 8). Meanwhile, cognitive maps represent how an individual understands those relationships (Allen et al., 1993, p. 8).

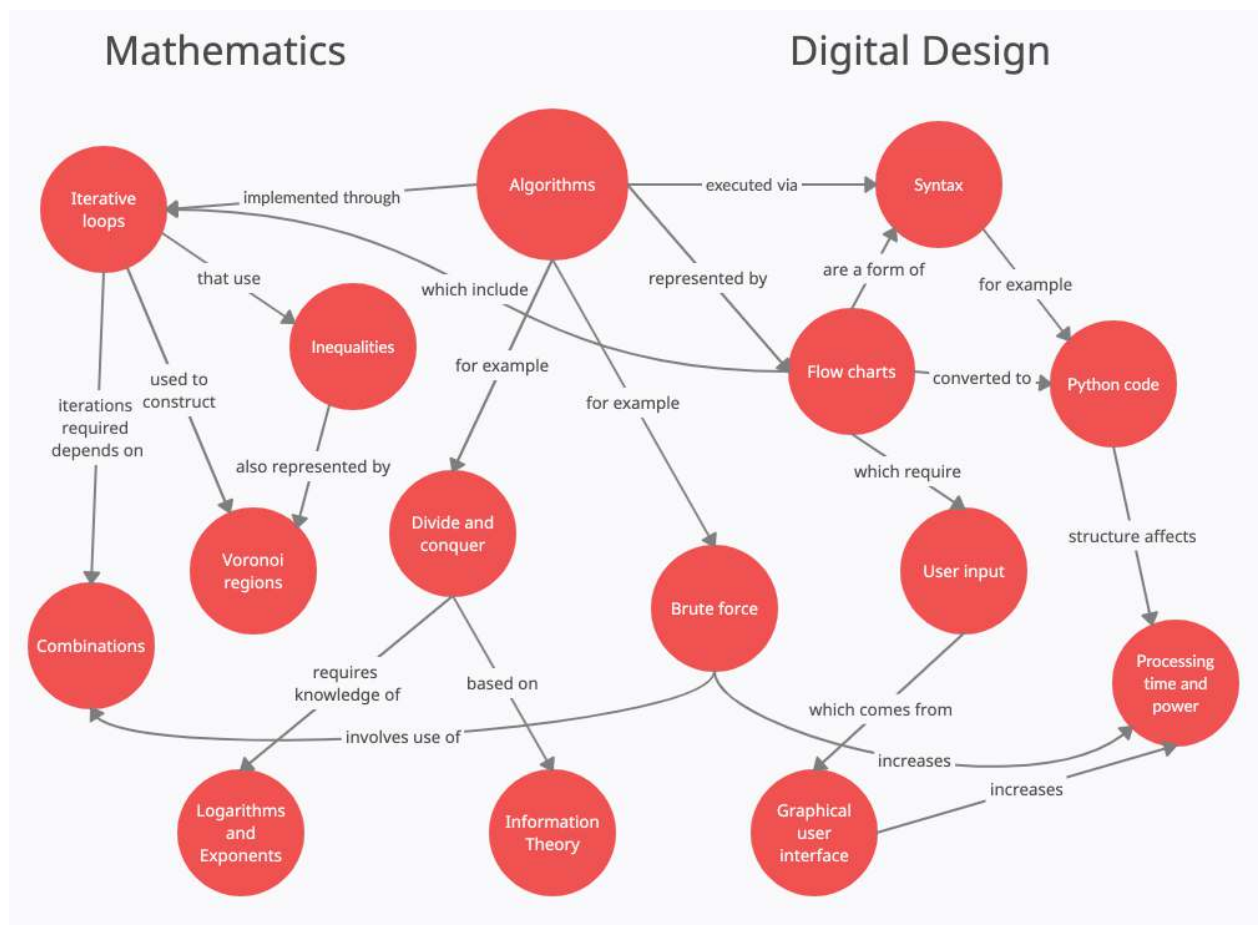
For a teacher with strong content knowledge, a cognitive map and a concept map are effectively the same thing. Thus, teachers create a cognitive map of their subject expertise as a first step in creating a curriculum map for a new curriculum. Mc Daniel et al. (2005) describe the process by which these teacher-created cognitive maps can be transformed into curriculum maps. They write “connections among elements can be described and organized so as to lead the development of lesson materials” and “mapping serves as a device to tie assessment plans to the overall structure of the course, ensuring that student learning is effectively assessed” (2005, p. 510). For existing or draft integrated curriculum designs, viewing the unit topics of a connected whole can help educators to identify topics that are unnecessary (Mc Daniel et al., 2005) and perhaps discover synergies between disciplinary topics that were previously unnoticed. Concept mapping can also benefit curriculum revision, as they can help educators to visualize and improve things such as curriculum cohesion, topic sequencing and the alignment between curriculum, resources and assessment (Simon, 2010).

Creating a concept map

Considering the above principles, a concept map for the integrated mathematics and design unit described in Modules 1 to 3 (Wallace, 2021a; Wallace 2021b; Wallace, 2021c) was created (see Figure 1 below). The concept map includes all topics and concepts from the graphic organizer for incorporating the five principles of integration (2021a, p. 7) and the unit assessment plan (2021c, p. 5), perhaps with the exception of Geogebra (although the use of this software is considered to be prior knowledge for students who would be studying the unit). In addition, the concept map aligns well with the unit essential questions (2021b, p. 7).

Figure 1

Concept Map for Integrated Mathematics and Design Unit



Note. Created by author in Creately.

The benefits of planning wheels

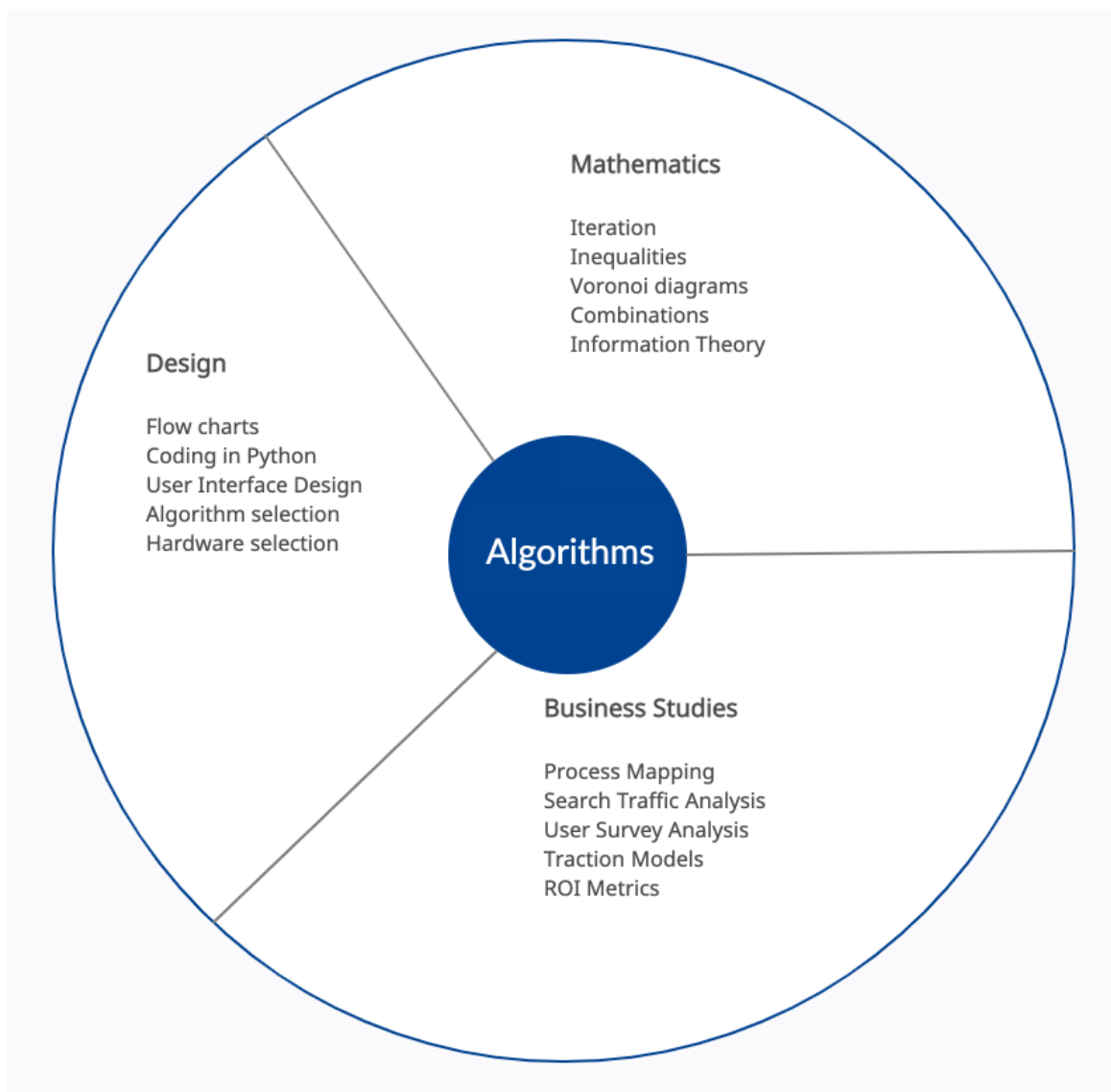
Planning wheels are a teacher-friendly tool for designing multidisciplinary units, or at least identifying possibilities for making explicit links between subjects within a grade level. Teachers can meet in cross-disciplinary groups and identify the topics that will form the overview of a planned multidisciplinary unit (Palmer, 1991). The planning wheel can also be a catalyst for forming and a way of organizing connections between existing units (Palmer, 1991, p. 59). In the case of existing interdisciplinary units, it can be used to expand the design from interdisciplinary to multidisciplinary by adding a third subject.

Creating a planning wheel

To that end, a planning wheel for a proposed multidisciplinary mathematics, design technology and business studies unit was created (see Figure 2 below). Business studies was chosen as the third discipline as it aligns well with the unit essential questions and the entrepreneurial goals of the unit culminating assessment.

Figure 2

Planning Wheel for Integrated Mathematics and Design Unit



Note. Created by author in Creately.

Conclusion

The addition of a third discipline, business studies, to the integrated mathematics and design technology unit created an opportunity to better align the unit content with the authentic assessment design described in Module 3 (Wallace, 2021c). The planning wheel allowed all the essential topics from the concept map in Figure 1 to be retained, while adding business studies topics that connect meaningfully with the real-world context of the unit project. Integration was logical and natural as the focus business studies topics chosen can also be related to the central unifying theme of algorithms. In summary, graphic organizers such as concept maps and planning wheels are useful tools for designing new integrated curriculum units and also for making connections between existing units. By creating a holistic overview of the topics and concepts of interest, collaborating teachers can identify potential synergies and overlaps, thus leading to curriculum that is more efficient and aligned with learning outcomes.

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