Determine Teaching Content using a Bottom-up Approach

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Abstract. The bottom-up approach refers to listing the knowledge points needed for some practical applications and then combining these knowledge points into a knowledge system. Practice courses or elective courses are generally more suitable for using the bottom-up approach. This paper focused on determining the teaching content bottom-up and proposed four teaching organization method for different situations taking account for the quantity and the volume of the supplementary knowledge points, by which a well-organized teaching arrangement could be obtained.

1. Introduction

The bottom-up approach refers to listing the knowledge points needed for some practical applications and then combining these knowledge points into a knowledge system. Practice or elective courses are generally more suitable for using the bottom-up approach. In this paper, we will focus on determining the teaching content by bottom-up approach. According to the quantity and the volume of the supplementary knowledge points, it can be divided into four situations: less quantity with less volume, large quantity with less volume, large quantity with less volume and large quantity with large volume. We will take different teaching organization taking account for these four different situations.

2. Determining the Teaching Content Bottom-Up

Determining the teaching content by bottom-up approach refers to listing the knowledge points needed for some practical applications and then combining these knowledge points into a knowledge system.

For each certain practical application, we list all the knowledge points needed. We named the union of all these knowledge points as *original knowledge points*.

In an ideal situation, the original knowledge points constitute a complete knowledge points set. Here 'complete knowledge points set' refers to a knowledge points set with highly systematic and cohesive in a knowledge system (as shown in Fig.1a). Such original knowledge points set can be arranged as the teaching content of a course directly.
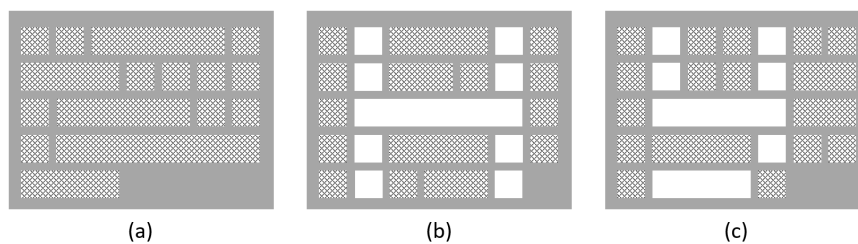

Figure 1. The original knowledge points and the knowledge system

But in most cases, the original knowledge points set is incomplete (as shown in Fig.1b and Fig.1c). Some additional knowledge points that supplement to the knowledge systematize the course. We named the union of all these additional knowledge points as *supplementary knowledge points*.

3. Teaching Organization in Different Situations

According to the quantity and the volume of the supplementary knowledge points, it can be divided into four situations as shown in Fig.2: less quantity with less volume, large quantity with less volume, large quantity with less volume and large quantity with large volume. We will take different teaching organization according to the four different situations.
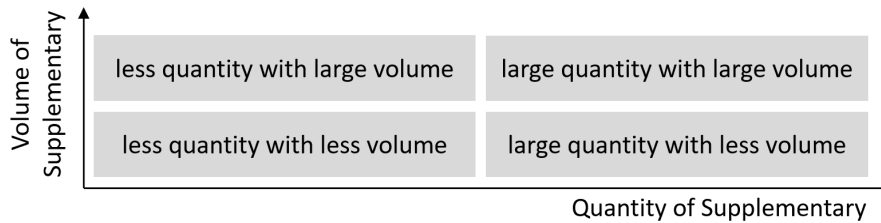

Figure 2. Situations according to the quantity and the volume of the supplementary knowledge points

3.1 Situation A

Situation A is the situation that the quantity and the volume of the supplementary knowledge points are both less (as shown in Fig.3). Situation A is second only to the ideal situation. That would be convenient for the organization of the classroom teaching. We can regard the supplementary knowledge points as the original knowledge points and arrange the teaching content without particularly teaching organization processing.
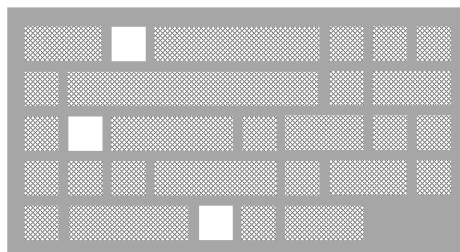

Figure 3. Situations A of the supplementary knowledge points

3.2 Situation B

Situation B is the situation that the quantity of the supplementary knowledge points is large and the volume of the supplementary knowledge points is less (as shown in Fig.4). The teaching of the supplementary knowledge points would be arranged among the original knowledge points. Taking account for the logical relationship between the supplementary knowledge points and the original knowledge points, the approaches are different.

When the original points could not be understood without the supplements, the supplementary knowledge points should be taught before. In that case, before teaching the original knowledge, the all necessary knowledge points have been taught.

In contrast, if the understanding of the supplementary knowledge points needs the original knowledge points, the supplementary knowledge points should be taught after the original knowledge points. It would be assured that the necessary knowledge has been taught before teaching the supplementary knowledge points.
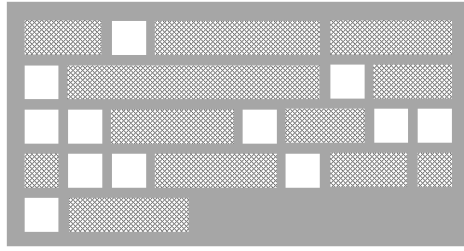
Figure 4. Situations B of the supplementary knowledge points

If there is no logical order between the supplementary knowledge points and the original knowledge points, the supplementary knowledge points could be taught at the beginning or the end of each knowledge unit. Teaching at the end of the knowledge unit is recommended because that the supplementary knowledge points would not overwhelm the original knowledge points.

3.3 Situation C

Situation C is the situation that the quantity of the supplementary knowledge points is less and the volume of the supplementary knowledge points is large (as shown in Fig.5). Because the volume of the supplementary knowledge points is large, the supplementary knowledge points could not be taught during teaching the original knowledge points. Some special topics are needed. Generally, the supplementary knowledge points would be taught as a separate section at the last lesson of each chapter.
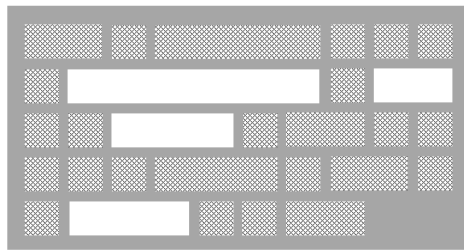

Figure 5. Situations C of the supplementary knowledge points

3.4 Situation D

Situation D is the situation that the quantity and volume of the supplementary knowledge points are both large (as shown in Fig.6). That would be the worst situation.
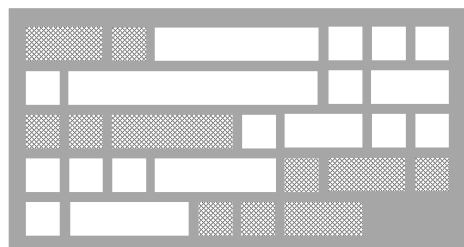

Figure 6. Situations D of the supplementary knowledge points

One possibility is that the original knowledge points of syllabus are too separate to consist of a logical system. The large amount of supplementary knowledge points should be introduced in order the complete the knowledge system. Another possibility is that the combination scheme cannot combine the knowledge points to be a logical system.

For the first case, we can consider to optimize the syllabus and try to select knowledge points with high cohesion in a system. Other knowledge points can be considered to be taught in other courses. For the second case, we can consider that the optimized combination scheme is used to reduce the supplementary knowledge points.

4. Conclusion

The bottom-up approach refers to listing the knowledge points needed for some practical applications and then combining these knowledge points into a knowledge system. Practice or elective courses are generally more suitable for using this method. In this paper, we focused on determining the teaching content bottom-up. According to the quantity and the volume of the supplementary knowledge points, it could be divided into four situations: less quantity with less volume, large quantity with less volume, large quantity with less volume and large quantity with large volume. We took different teaching organization taking account for the four different situations, by which a well-organized teaching arrangement could be obtained.

Acknowledgement

References

[1] J.D. Novak, Learning, Creating, and Using Knowledge Concept Maps as Facilitative Tools in Schools and Corporations (Second Edition), New York: Routledge, 2010.

[2] J.D. Novak, D.B. Gowin, Learning How to Learn. Cambridge:Cambridge University Press, 1984.

[3] J.D. Novak, A Theory of Education. Ithaca: Cornell University Press, 1977.

[4] T. Buzan, B. Buzan, The Mind Map Book: How to Use Radiant Thinking to Maximize Your Brain's Untapped Potential, New York:Plume, 1996.

[5] Z. Jiang, The application study of knowledge point relation and its structure diagram and knoeledge network, Journal of Anshan Normal University, Vol. 7(5), pp. 99-101, 2005.

[6] S. Xie, Analysis of relationships in knowledge structure, Computer Engineering and Applications, Vol. 38, pp. 243-244, 2002.

[7] S. Xie, Analysis of the properties of knowledge points and their networks, Journal of Software, Vol. 9(10), pp. 785-789, 1998.