CHAPTER 6

EXAMINATION OF HIGHER ORDER THINKING SKILLS IN BIOLOGY EDUCATION

Ufuk TÖMAN[1]

INTRODUCTION

With the developments in science and technology, competition between countries has accelerated. It is because the development of a country is directly proportional to its best adaptation to the changes and developments occurring in the world (Kurnaz, 2011). In this process, individuals in the society must be equipped individuals for a developed country. Individuals who have scientific thinking power, have responsibility towards the society, think critically, produce solutions to the problems they face, and use their lives as solutions, can be described as equipped individuals (Aslan, 2018; Ergüven, 2011).

The process of change that occurs against any event or situation by individual using the brain is defined as "thinking" (Varga, 2011). When this change perceives the process as thinking, the thinking process of the individual must be from knowledge, comprehension and application, which are the first step of cognitive steps, to the final step of analysis, synthesis and evaluation (Sönmez, 2012; Şenol, 2015). In order to reach the top of these steps, it is important to have educational practices that prioritize the development of thinking skills. A programmatic training process should be created for the purpose in order to provide individuals with higher order thinking skills (Açışlı, 2016; Porntaweekul, Raksasataya & Nethanomsak, 2016).

One of the most important elements of education is surely thinking. Individuals spend every stage of their social life in interaction with the act of thinking. This interaction both prepares the individuals for life and enables them to live their

[1] Dr, Bayburt University, Bayburt Education Faculty, Bayburt/Turkey utoman@bayburt.edu.tr
ORCID: (0000-0003-3545-7097)

- Given that the postgraduate studies for higher order thinking skills in biology education are not sufficient, the number of studies in this field should be increased.
- When the studies conducted are analyzed, it is concluded that data collection tools and methods that mainly adopt the quantitative research approach were used, and it can be suggested to use data collection tools and research methods that adopt the qualitative research approach. Thus, detailed and in-depth information can be obtained regarding the situations in which higher order thinking skills are included.
- Programs of instruction and textbooks for biology education should support the development of higher order thinking skills.
- Conducting adequate and qualified studies for higher order thinking skills should not be seen as a periodic problem, and these studies should be done at all educational levels where biology education is conducted.
- The scope of studies dealing with higher order thinking skills for biology education can be expanded by also covering article and project studies.

REFERENCES

Açışlı, S. (2016). Sınıf öğretmeni adaylarının öğrenme stilleri ile eleştirel düşünme eğilimlerinin incelenmesi. *İlköğretim Online Dergisi*, 15(1), 273-285.

Akdere, N. (2012). *Türkiye'de öğretmen adaylarının eleştirel düşünme becerileri, eleştirel düşünme öğretimine yönelik tutumları ve öz yeterlik seviyeleri*. Doktora Tezi, Orta Doğu Teknik Üniversitesi Sosyal Bilimler Enstitüsü, Ankara.

Aslan, S. (2018). Investigating the relation between educational philosophies adopted by prospective teachers and their teaching-learning conceptions. *Pegem Eğitim ve Öğretim Dergisi*, 8(2), 307-326.

Bayat, N. (2014). Öğretmen adaylarının eleştirel düşünme düzeyleri ile akademik yazma başarıları arasındaki ilişki. *Eğitim ve Bilim*, 39(173), 155-168.

Chi, F. M. (2010). Reflection as teaching inquiry: Examples from Taiwanese in-service teachers. *Reflective Practice*, 11(2), 171-183.

Ergüven, S. (2011). *Öğretmenlerin yansıtıcı düşünme becerilerinin çeşitli değişkenler açısından incelenmesi*. Yüksek Lisans Tezi. Niğde Üniversitesi Sosyal Bilimler Enstitüsü, Niğde.

Güneş, K. (2015). *Bilim Sanat Merkezi Öğrencilerinin Problem Çözmeye Yönelik Yansıtıcı Düşünme Becerileri, Matematik Dersine Yönelik Tutumları ve Matematik Başarılarının İncelenmesi*. Yüksek Lisans Tezi. Çukurova Üniversitesi Sosyal Bilimler Enstitüsü. Adana.

Jayarajah, K., Saat, R.M. & Rauf, R.A.A. (2014). A review of science, technology, engineering & mathematics (STEM) education research from 1999–2013: A Malaysian perspective. *Eurasia Journal of Mathematics, Science & Technology Education*, 10(3), 155-163.

Karaoğlan Yılmaz, F. G., Olpak, Y. Z., & Yılmaz, R. (2018). The effect of the metacognitive support via pedagogical agent on self-regulation skills. *Journal of Educational Computing Research*, 56(2), 159-180.

Kurnaz, A. (2011). *Eleştirel düşünme öğretimi etkinlikleri (Planlama, uygulama ve değerlendirme)*. Konya: Eğitim.

Lukitasari, M., Hasan, R., & Murtafiah, W. (2019). Using critical analysis to develop metacognitive ability and critical thinking skills in biology. *Jurnal Pendidikan Biologi Indonesia*, 5(1), 151-158.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: an expanded source book. (2nd Edition).* Calif. : Sage Publications.

Neuendorf, K. A. (2002). *The content analysis guidebook. Thousand Oaks*, California: Sage Publications.

Olatunji, M. O. (2017). Critical thinking in Nigeria's pre-service teachers education: A philosophical investigation. *Journal of Teacher Education and Educators*, 6(2), 205221.

Polat, M., & Kontaş, H. (2018). Sınıf öğretmenlerinin eleştirel düşünme eğilimlerinin incelenmesi. *Electronic Journal of Social Sciences*, 17(65), 142-159.

Porntaweekul, S., Raksasataya, S., & Nethanomsak, T. (2016). Developing reflective thinking instructional model for enhancing students' desirable learning outcomes. *Educational Research and Reviews,* 11(6), 238-251.

Rodgers, C. (2002). Defining reflection: Another look at John Dewey and reflective thinking. *Teacher College Record,* 104(4), 842-886.

Sönmez, V. (2012). *Program geliştirmede öğretmen el kitabı*. Ankara: Anı.

Şenol, Ü. (2015). *Gazi Üniversitesi İngilizce Öğretmenliği Bölümündeki öğretmen adaylarının okuduğunu anlama becerilerinin edebiyat temelli eleştirel düşünme etkinlikleri ile geliştirilmesi üzerine deneysel bir çalışma*. Yüksek Lisans Tezi, Gazi Üniversitesi Eğitim Bilimleri Enstitüsü, Ankara.

Töman, U. & Çimer, O. S. (2014). Investıgatıon by skılls of pre-servıce scıence teachers' reflectıve thınkıng from journals. *Journal of Computer and Education Research (JCER),* 2 (4), 166-190.

Ünver, G. (2003). *Yansıtıcı düşünme.* Ankara: Pegem.

Varga, R. (2011). The importance of enhancing critical thinking skill of pre-service teachers. *Training and Practice,* 9(1-2), s.97-106**.**