Higher Education Studies; Vol. 4, No. 2; 2014
ISSN 1925-4741 E-ISSN 1925-475X
Published by Canadian Center of Science and Education

The Development of Critical Thinking in Professional and Academic Bachelor Programmes

Marie Evens[1], An Verburgh[1] & Jan Elen[1]

[1] Centre for Instructional Psychology and Technology, KU Leuven, Belgium

Correspondence: Marie Evens, Centre for Instructional Psychology and Technology, KU Leuven, Dekenstraat 2, postbox 3773, Belgium. E-mail: marie.evens@ppw.kuleuven.be

Received: January 13, 2014 Accepted: February 13, 2014 Online Published: March 27, 2014

doi:10.5539/hes.v4n2p42 URL: http://dx.doi.org/10.5539/hes.v4n2p42

Abstract

Critical thinking is an important goal in higher education. Students are expected to grow in critical thinking during their higher education programme. The present study investigates the development of critical thinking in 1134 bachelor students in Flanders, Belgium. The study followed a mixed longitudinal design. Students' critical thinking was measured by the Scipio, a test consisting of both constructed response items and forced choice items. The analyses were split up for academic and professional bachelor students. Students in both academic and professional bachelor programmes are shown to become better critical thinkers during the first two years of study, although the specific growth patterns of both programme types are different. Professional bachelor students show a large growth in the first year of higher education, but do not improve their critical thinking during the next two years. Academic bachelors on the other hand show a moderate growth in the first year and continue developing their critical thinking during the next years, leading to a higher overall growth than professional bachelor students.

Keywords: critical thinking, development, professional higher education, academic higher education, bachelor programmes

1. Introduction

Critical thinking (CT) is an important educational goal (Halpern, 1998; Ku, 2009; Tsui, 2002). All disciplines and levels of education aim at preparing individuals to think well and to think for themselves (Pithers & Soden, 2000). CT is claimed to be essential for active and engaged citizenship (Kuhn, 1999; Moore, 2004). It is argued to prepare students for a multitude of challenges that they will face in their personal lives and their careers (Halpern, 1998; Tsui, 2002). According to Tsui (2002), CT encourages students to become independent lifelong learners. Its importance has been emphasized in several European studies as well as studies in the rest of the world (Halpern, 1998; Ku, 2009; Pithers & Soden, 2000; Ten Dam & Volman, 2004; Tsui, 2002; Verburgh, Schouteden, & Elen, 2013).

In the research literature, CT is defined in many different ways (Bailin, Case, Coombs, & Daniels, 1999). According to Halpern (1998, 1999), CT is the kind of purposeful, reasoned and goal-directed thinking that one needs in order to solve problems, make decisions, formulate inferences and calculate likelihoods. According to Facione (1990), CT is reasonable and reflective thinking that is focused on the decision what to believe or what to do. He defined it as "purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological or contextual considerations upon which that judgment is based" (Facione, 1990, p. 3).

Although there is no absolute agreement about the definition of CT, there is consensus among researchers that CT consists of both skills and dispositions (Halpern, 1999, 2007; Ku & Ho, 2010). According to Facione (1990) interpretation, analysis, evaluation, inference, explanation, and self-regulation are the major skills composing CT. Halpern (1998) constructed a taxonomy of five categories of CT skills: verbal reasoning skills, argument analysis skills, skills in thinking as hypothesis testing, likelihood and uncertainty, and decision-making and problem-solving skills. However, possessing CT skills is not enough to be a critical thinker. One also needs to have an inclination to apply these skills. The disposition towards CT allows a person to recognize when a certain skill is required and to apply this skill (Ku & Ho, 2010). The most important dispositions to CT are, according to Halpern (2008): the willingness to engage in and persist at a complex task, the habitual use of plans, the

suppression of impulsive activity, flexibility, open-mindedness, the willingness to abandon nonproductive strategies in an attempt to self-correct, and an awareness of the social realities that need to be overcome so that thoughts can become actions.

Several studies investigated the development of CT in higher education. Most of them found a small increase in CT during higher education (Arum & Roksa, 2011; Astin, 1993; Bers, McGowan, & Rubin, 1996; Giancarlo & Facione, 2001; Hagedorn et al., 1999; Klein, Benjamin, Shavelson, & Bolus, 2007; McMillan, 1987; Miller, 1992; A. R. Saavedra & J. E. Saavedra, 2011; Saucier, 1995). Similarly, during higher education a small development in epistemic reasoning, which is closely related to CT (Brabeck, 1983), has been established (Baxter-Magolda, 2002; Hallet, Chandler, & Krettenauer, 2002; Kitchener, 2002; King & Kitchener, 2004; Wood & Kardash, 2002). However, Bok (2006) drew attention to the fact that the established growth in CT in most studies is limited. Similarly, Arum and Roksa (2011) highlighted that a significant proportion of students in their study showed no growth at all. Pascarella, Blaich, Martin, and Hanson (2011) replicated Arum and Roksa's study and found closely matching results. Arum and Roksa attributed the overall limited growth in CT to students becoming more and more academically adrift. Among students in HE institutions seems to live a culture that encourages them to achieve as much as possible with minimal effort. Furthermore, Arum and Roksa claim that universities do not pay enough attention to teaching in general. Similarly, Bok (2006) stresses the gap between what researchers consider important and the behavior of people in a teaching position. It is however unclear whether these conclusions, that are drawn based on research in the US, are valid in the context of European and more specifically Flemish higher education. The present study tries to provide more insight into this issue.

Although most studies found some, be it a limited, growth in CT, it remains unclear how CT exactly develops during higher education and at what moment the largest growth in CT takes place. Lehmann (1963) found in a longitudinal study that the largest growth occurs during the first year of higher education. Recent research that confirms this result is, however, lacking. This is partly due to the difficult character of longitudinal research in higher education. Furthermore, in the literature no differences in CT development across higher education programmes are reported.

Evens, Verburgh, and Elen (2013) found differences in CT development during the first year of higher education between Flemish professional and academic bachelor students. Professional bachelor programmes prepare students for the labour market. Academic bachelor programmes are followed by master programmes. Because of the differences in CT that are found between these programme types in the freshman year, it is interesting for the present study to investigate whether professional and academic students experience a different development of CT in subsequent years of higher education as well.

The following research questions are investigated in the present study:

Research question 1: Do professional and academic students grow in CT between the beginning and the end of their bachelor programme?

Research question 2: Do students grow in CT in each separate year of higher education? In which year of professional and academic bachelor programmes does the largest growth in CT take place?

2. Method

2.1 Overall Design

The study took place in the educational context of Flanders, Belgium. The development of CT is an important and recurrent aim in Flemish higher education programmes and courses (Verburgh et al., 2013), but it has not yet been systematically studied. In Flanders, higher education is organized according to the bachelor-master structure. Higher professional education is organized at university colleges and offers bachelor programmes that consist of 180 European Credit Transfer and accumulation System (ECTS) points, which requires three years of full-time study. Professional bachelor programmes are scaled at 5B medium level in the OECD's International Standard Classification of Education (ISCED-97). Higher academic education is provided by universities and includes bachelor and master programmes. Academic bachelor programmes also consist of 180 ECTS points. They are scaled at 5A level in the ISCED-97 (Verburgh et al., 2013).

The study followed a mixed longitudinal design, which is a combination of longitudinal and cross-sectional approaches (Van't Hof, Roede, & Kowalsky, 1977). It was longitudinal in that participants' CT was tested both at the beginning (pre-test) and at the end (post-test) of the same academic year, which enabled to calculate growth scores for students who participated twice. Furthermore, the study was cross-sectional because students from three years of study were tested at the same time, which allowed to make comparisons over different years of study. The design of the study is visualized in Figure 1. Separate analyses were done for professional and

academic bachelor programmes because there are differences in growth between the first years of both programme types (Evens et al., 2013). In order to facilitate comparability between the academic and the professional programmes, only bachelor students were included in the sample.

Because of the small number of participants in the post-test of the third bachelor year (n = 54 for the professional bachelors, n = 61 for the academic bachelors), the third bachelor students were left out of the sample for research question 1. Hence, to find an answer on research question 1 CT performances in the beginning of the first year were compared with CT performances at the end of the second year in a cross-sectional design. In research question 2 the growth during the first three years was studied in a more detailed way. The growth in CT in each year of study was investigated in a longitudinal design. Afterwards, the growth scores were compared with each other in order to find out in which year the largest growth in CT took place.

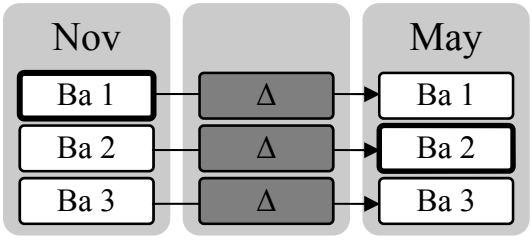

Figure 1. Design of the study

Note. Boxes with a bold outline are compared in research question 1. Boxes with a gray background are compared in research question 2.

2.2 Participants

The sample consisted of 1134 participants. The participants were recruited from 12 educational programmes in six institutions of higher education in Flanders. The institutions were taking part in a larger research project that focused on research integration in higher education. For this larger project, 18 educational programmes were contacted, of which 12 agreed to participate. The remaining six programmes mostly refused because of practical reasons (e.g., a lack of available computer rooms). The programmes themselves could choose whether their first, second or third bachelor students participated in the test administrations, and whether all the students of a particular year of study had to participate or only a few randomly selected class groups. The sample consisted of 597 first year bachelor students, 330 second year bachelor students and 207 third year bachelor students. There were more female (n = 703) than male (n = 428) participants. 630 participants followed a professional bachelor programme and 487 participants were academic bachelor students. 976 participants took part in the pre-test and 639 participants took part in the post-test. 481 participants took part twice.

2.3 Instruments

To measure CT the Scipio was used (Verburgh, François, & Elen, 2012). This is a Dutch test based on the Cornell Critical Thinking Test (CCTT; Ennis, Millman, & Tomko, 2005) and the Halpern Critical Thinking Assessment (HCTA; Halpern, 2007). The SCIPIO consists of 17 situations with both constructed response items and forced choice items. Two situations were based on the "meaning and fallacies" and "identification of assumption" scales of the CCTT. The other items are taken from the HCTA. The test starts with an example situation with three questions and possible answers to make participants familiar with the instrument. At the end of the test background information is asked, e.g. date of birth, sex, field of study, institution, year of study and language proficiency. An example test item can be found in Figure 2. In the Scipio this item is followed by a forced choice question on the same topic.

The maximum score that can be obtained on the Scipio is 95. The maximum score differs per item, ranging between one and ten. The answers on the constructed response items were graded with an elaborated scoring key. Interrater reliability is high; ranging between .70 and .98 (Verburgh, François, Elen, & Janssen, 2013). The reliability of the test is moderate (Cohen, 1988) with, depending on the moment of administration, a Cronbach's α between .61 and .67. This result exceeds reliability scores of other CT tests. After translation of the HCTA and the CCTT in Dutch, François, Verburgh, and Elen (2010) found Cronbach's α's ranging between .56 and .72 (for the HCTA) and of .52 (for the CCTT).

Item 21, Part 1 of the HCTAES test (Question 41)

Suppose that you are a first-year student at a dental school. You realize that your new friend, who is also a first-year student in dental school, is getting drunk on a regular basis several times a week. You do not see any signs of her drinking problem at school, but you are concerned because you will both begin seeing patients at the school's dental clinic within a month. She has not responded to your hints about her drinking problem. As far as you know, no one else knows about her excessive drinking.

(A) State the problem in two ways.

(B) For each statement of the problem, provide two different possible solutions.

Figure 2. Example item of the Scipio, taken from the HCTA. Adapted from Saiz and Rivas (2008)

2.4 Procedure

There were two test administrations, namely in October–November (pre-test) and in May (post-test) of the same academic year. Test administrations took place in the participating institutions for higher education. Students were asked to fill in the Scipio during lecture time, in order to make sure that all selected students were induced to participate. Participants got one hour to complete the test. Mostly the test was taken digitally. In one institution a paper version was administered.

2.5 Data-Analysis

In order to find an answer on research question 1 independent samples *t*-tests were performed, in which entrance CT performances in the first year were compared with end performances in the second bachelor year. For research question 2 pre-test performances and post-test performances in each year were compared with each other by means of paired samples *t*-tests. Hence, only participants who took part in both the pre-test and the post-test were included in the analyses for research question 2. Due to this decision selective attrition was avoided. When the paired samples *t*-tests could reveal a significant growth in more than one year of study, one-way ANOVA was used to find out in which year the largest growth in CT took place. In these analyses the average growth in CT in the subsequent years of study was compared.

Participants who scored three or more standard deviations from the mean were classified as outliers and removed from the sample (Field, 2005). After removing the outliers, 619 professional bachelor students and 482 academic bachelor students remained in the sample. The specific distribution of participants per year after removal of the outliers can be found in Table 1 and 2.

Table 1. Descriptive statistics of the professional bachelors ($N = 619$)

		Pre-test			Post-test		
		n	*M*	*SD*	*n*	*M*	*SD*
First bachelor	Total	270	49.63	8.01	131	51.55	9.62
	Pre + post	101	48.37	7.66	101	51.82	9.74
Second bachelor	Total	172	51.14	7.70	133	51.98	7.80
	Pre + post	104	52.17	7.79	104	52.11	7.65
Third bachelor	Total	122	51.99	8.04	54	51.65	9.15
	Pre + post	41	53.93	8.10	41	52.95	8.06

Note. Total = all participants that took part in the pre-test, the post-test or both tests. Pre + post = those participants that took part in both the pre-test and the post-test.

Table 2. Descriptive statistics of the academic bachelors (N = 482)

		Pre-test			Post-test		
		n	*M*	*SD*	*n*	*M*	*SD*
First bachelor	Total	255	50.49	7.80	174	52.64	7.85
	Pre + post	140	50.81	7.61	140	52.58	7.95
Second bachelor	Total	111	53.24	7.21	76	55.08	8.85
	Pre + post	65	54.15	7.18	65	56.45	8.04
Third bachelor	Total	35	52.06	7.58	61	53.05	8.01
	Pre + post	26	51.15	8.05	26	56.27	8.45

Note. Total = all participants that took part in the pre-test, the post-test or both tests. Pre + post = those participants that took part in both the pre-test and the post-test.

3. Results

3.1 Research Question 1

Table 1 shows descriptive statistics for the professional bachelor students. The independent samples t-test could reveal a significant growth in CT during the first two professional bachelor years. Differences between the beginning of the first year and the end of the second year were significant, $t(401) = -2.80$, $p < .01$, $r = .14$. The descriptive statistics of the academic bachelor students can be found in Table 2. The analyses indicated that the growth between the beginning of the first year and the end of the second year was significant for the academic bachelor students as well, $t(329) = -4.36$, $p < .001$, $r = .24$.

As shown by Figure 3 and 4, the growth during the first two years was larger in the academic bachelor programmes ($M = 4.59$, $SD = 1.05$) than in the professional bachelor programmes ($M = 2.35$, $SD = .84$). As a consequence, academic bachelor students ($M = 55.08$, $SD = 8.85$), who already had slightly better first year pre-test performances than professional bachelors, increased their advantage over the professional bachelors ($M = 51.98$, $SD = 7.80$) at the end of the second bachelor year.

3.2 Research Question 2

As shown in Table 1 and Figure 3, the lowest mean performances of the professional bachelor students are obtained by first bachelor students at the beginning of the year ($M = 48.37$, $SD = 7.66$). At the end of the first year the mean score is higher ($M = 51.82$, $SD = 9.74$). At the beginning of the second year the mean score is again higher ($M = 52.17$, $SD = 7.79$), but during the second year the mean score remains more or less the same, leading to a mean score of 52.11 ($SD = 7.65$) at the end of the year. At the beginning of the third year the mean score is 53.93 ($SD = 8.10$). At the end of the third year the mean performance is again lower ($M = 52.95$, $SD = 8.06$). Paired samples t-tests were performed to check the significance of differences in mean scores for the professional bachelor students. Only in the first bachelor year a significant growth in CT took place, $t(100) = -4.44$, $p < .001$, $r = .41$.

As shown in Table 2 and Figure 4, in the first two bachelor years the mean performances of the academic students continued to increase. First bachelor students scored on average 50.81 ($SD = 7.61$) at the beginning of the year and 52.58 ($SD = 7.95$) at the end of the year. The mean scores of second year bachelor students also increased between the beginning ($M = 54.15$, $SD = 7.18$) and the end ($M = 56.45$, $SD = 8.04$) of the academic year. In the third bachelor year the mean score was again lower ($M = 51.15$, $SD = 8.05$) at the start, but at the end of the year the average score increased until 56.27 ($SD = 8.45$). Analyses indicated that the growth in CT was significant during the first ($t(141) = -3.19$, $p < .01$, $r = .26$), the second ($t(64) = -2.48$, $p < .05$, $r = .30$) and the third bachelor year ($t(25) = -3.56$, $p < .01$, $r = .34$). The largest growth took place in the third bachelor year ($M = 5.12$, $SD = 7.33$). In order to find out whether the differences in growth were significant one-way ANOVA was used. The analyses indicated that there were no significant differences in growth between the years of study, $F(3) = 1.82$, $p > .05$, $\omega^2 = .01$.

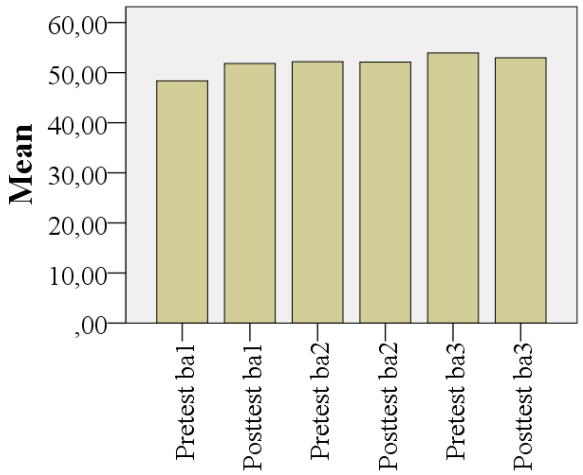

Figure 3. Bar chart of the mean scores of the professional bachelor students by test administration

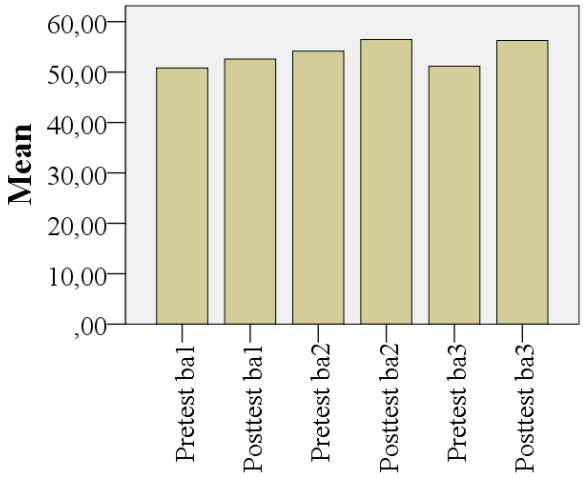

Figure 4. Bar chart of the mean scores of the academic bachelor students by test administration

4. Discussion

Research question 1 examined in a cross-sectional design whether CT grows during the first two bachelor years. Both for the professional and the academic students a significant growth in CT during the first two bachelor years was found. Professional and academic higher education seem to accomplish the educational goal of promoting students' CT. This finding creates an image that is different from the more negative results of previous research about the development of CT in higher education (Arum & Roksa, 2011; Bok, 2006; Pascarella et al., 2011). This might indicate differences in the educational systems of Europe (Flanders) and the U.S.

The present study is innovative in studying the differences in CT development between programme types in higher education. Academic bachelor students were found to experience the largest growth in CT. They already had higher entrance performances than professional bachelor students, so their advantage increased at the end of the second year. Before elaborating on the larger overall growth of the academic bachelor students, it is interesting to first have a look at the more detailed growth patterns that were studied in research question 2.

Although both academic and professional bachelor students showed a growth in CT during the first two years of higher education, their specific growth patterns were different. Research question 2 studied the growth in each year of study in a longitudinal design. Academic bachelor students showed a growth in CT in each of the three bachelor years. They showed the largest growth in the third bachelor year. The presence of growth in CT during academic bachelor programmes is in accordance with prior research (Astin, 1993; Bers et al., 1996; Giancarlo & Facione, 2001; Hagedorn et al., 1999; Klein et al., 2007; McMillan, 1987; Miller, 1992; A. R. Saavedra & J. E. Saavedra, 2011; Saucier, 1995). A possible explanation for the finding that the largest growth took place in the third year of academic higher education is the idea that the first years of academic higher education emphasize reproduction of learning contents more than CT. Dutch research shows that most first year exams do not require students' use of critical, analytical and concrete processing strategies (Vermunt, 2005). This explanation assumes that the educational practice in the third year is different. However, the high growth score in the third year could also be biased because of the small number of participants in the third bachelor year. Similarly, selection bias could play a role; it might be possible that the students that dropped out between the first and the third year are the weakest critical thinkers. However, the growth in the first two years is significant, meaning that academic higher education seems to succeed in contributing to the development of students' CT.

The results of professional bachelor students were different. These students showed a very large growth in the first bachelor year, but did not grow significantly in CT during the second and third year. The finding that professional bachelor students show a growth in CT during the first two years, which was shown in research question 1, is only due to the large growth that occurs in the first bachelor year. The finding that first year students experience the largest growth confirms the results of Lehmann (1963). The absence of growth in the second and third year is however not in accordance with previous research (Astin, 1993; Bers et al., 1996; Giancarlo & Facione, 2001; Hagedorn et al., 1999; Klein et al., 2007; McMillan, 1987; Miller, 1992; A. R.

Saavedra & J. E. Saavedra, 2011; Saucier, 1995). A possible explanation for this finding is the idea that students make a major advancement in the first year of higher education because of their very weak starting position. Research shows that CT levels of students leaving secondary education are on average low because of the production oriented and teacher centered nature of secondary education (de Jager, 2012; Shaila & Trudell, 2010; Vermunt, 2005). The smaller growth in the second year of professional higher education could be caused by habituation of the students to the system of higher education. The absence of a large advancement in the first year of academic higher education could be explained by its more production oriented nature and the use of larger student groups (Vermunt, 2005). Another explanation for the absence of growth in the second and the third professional bachelor year is the possibility that the strongest students of professional bachelor programmes transfer to academic bachelor programmes after the first year because they do not feel sufficiently challenged, which has a negative influence on the average CT performance of the group of students that does proceed to the second year of professional higher education. However, this explanation is not very plausible because in Flanders this transition is rarely made by students.

When comparing both programme types, it seems clear that, although professional bachelor students make a larger advancement in the first bachelor year, academic bachelor students show the largest growth in CT during higher education. It is unclear whether the advantage of academic students is caused by instructional variables or by background characteristics of the students. On the one hand, the fact that academic students have better entrance performances in the first bachelor year than professional students indicates an influence of background characteristics. Van Houtven, Peters, and El Morabit (2010) for example showed that first year academic students outperform their peers in professional bachelor programmes on reading comprehension and summarizing, which are skills that play a role in CT (Halpern, 1998). Furthermore, students' age might play a role. Flemish professional bachelor students are on average one year older than academic bachelor students (Department of Education and Training, 2009) and research has shown that older students are better critical thinkers (Saarmann, Freitas, Rapps, & Riegel, 1992; Tiessen, 1987; Wangensteen, Johansson, Björkstrom, & Nordström, 2010; Yeh & Chen, 2005). This might explain why gains in CT occur earlier in professional than in academic bachelor programmes. On the other hand, the finding that academic bachelor students experienced a larger growth in CT during the first two years could also suggest an influence of instruction. Curricular differences between the programme types might cause a faster initial growth in CT among professional bachelor students but a more consistent growth trajectory among academic students. Another possibility is the idea that educators understand the concept of CT in a different way in professional and academic education. Verburgh (2013) distinguished four specifications of CT in descriptions of higher education teaching staff; CT towards oneself, CT towards information, consciousness of the perspective of others and ability to handle uncertainty. A different understanding of CT might be a reason why academic and professional teachers, while both aiming at promoting students' CT, attain different results.

The present study gave a detailed look at the differences in CT growth between professional and academic bachelor students. It would be interesting for further research to search for the reasons of these differences, e.g., by taking into account students' background characteristics, effects of maturation, etc. Furthermore, further research could use a fully longitudinal design, in which also the third bachelor students and master students are included. Finally, there is a need for in-depth analyses that study instruction in both programme types.

5. Conclusion

This study examined the development of CT in professional and academic bachelor programmes. In both programme types a significant growth over the first two bachelor years was found, which creates an image that is different from the more negative results of previous research. The specific growth in the separate years of study was different in the two programme types. Professional bachelor students make a large advancement in the first year of higher education, but do not grow in CT during the next two years. Academic bachelors on the other hand show a moderate growth in the first year, but they manage to continue improving their CT during the next years. Hence, in general academic bachelor students perform better than professional bachelor students. The importance of the present study lies in the fact that different patterns of CT development were found in different programme types.

References

Arum, R., & Roksa, J. (2011). *Academically adrift: Limited learning on college campuses*. Chicago: The University of Chicago Press.

Astin, A. W. (1993). *What matters in college*. San Francisco: Jossey-Bass.

Bailin, S., Case, R., Coombs, J. R., & Daniels, L. B. (1999). Conceptualizing critical thinking. *Journal of*

Curriculum Studies, 31, 285-302. http://dx.doi.org/10.1080/002202799183133

Baxter-Magolda, M. B. (2002). Epistemological reflection: The evolution of epistemological assumptions from age 18 to 30. In B. K. Hofer, & P. R. Pintrich (Eds.), *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 231-260). Mahwah: Lawrence Erlbaum Associates.

Bers, T., McGowan, M., & Rubin, A. (1996). The disposition to think critically among community college students: The California Critical Thinking Disposition Inventory. *Journal of General Education, 45*, 197-223.

Bok, D. C. (2006). *Our underachieving colleges: A candid look at how much students learn and why they should be learning more*. Princeton: Princeton University Press.

Brabeck, M. M. (1983). Critical thinking skills and reflective judgment development: Redefining the aims of higher education. *Journal of Applied Developmental Psychology, 4*, 23-34. http://dx.doi.org/10.1016/0193-3973(83)90056-4

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale: Lawrence Erlbaum Associates.

De Jager, T. (2012). Can first year students' critical thinking skills develop in a space of three months? *Procedia—Social and Behavioral Sciences, 47*, 1374-1381. http://dx.doi.org/10.1016/j.sbspro.2012.06.829

Department of Education and Training. (2009). *Studentenmonitor Vlaanderen 2009: socio-economische kenmerken van studenten in het hoger onderwijs*. [Student monitor Flanders 2009: Socio-economic characteristics of students in higher education]. Retrieved January 10, 2014, from http://www.ond.vlaanderen.be/hogeronderwijs/publicaties/studentenmonitor_vlaanderen_2009.pdf

Ennis, R. H., Millman, J., & Tomko, T. N. (2005). *Cornell critical thinking test* (5th ed.). Pacific Grove, CA: Midwest Publications.

Evens, M., Verburgh, A., & Elen, J. (2013). Critical thinking in college freshmen: The impact of secondary and higher education. *International Journal of Higher Education, 2*, 139-151. http://dx.doi.org/10.5430/ijhe.v2n3p139

Facione, P. A. (1990). *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction. Research findings and recommendations*. Retrieved from ERIC database (ED315423).

Field, A. (2005). *Discovering statistics using SPSS* (2nd ed.). London: Sage.

François, S., Verburgh, A., & Elen, J. (2010, September). *Assessment of critical thinking critically assessed: Comparison on two tests*. Paper presented at European Conference on Educational Research, Helsinki, Finland.

Giancarlo, C. A., & Facione, P. A. (2001). A look across four years at the disposition toward critical thinking among undergraduate students. *The Journal of General Education, 50*, 29-55. http://dx.doi.org/10.1353/jge.2001.0004

Hagedorn, L. S., Pascarella, E. T., Edison, M., Braxton, J., Nora, A., & Terenzini, P. T. (1999). Institutional context and the development of critical thinking: A research note. *The Review of Higher Education, 22*, 265-285. http://dx.doi.org/10.1353/rhe.1999.0010

Hallett, D., Chandler, M. J., & Krettenauer, T. (2002). Disentangling the course of epistemic development: Parsing knowledge by epistemic content. *New Ideas in Psychology, 20*, 285-307. http://dx.doi.org/10.1016/S0732-118X(02)00011-9

Halpern, D. F. (1998). Teaching critical thinking for transfer across domains: Dispositions, skills, structure training, and metacognitive monitoring. *American Psychologist, 53*, 449-455. http://dx.doi.org/10.1037/0003-066X.53.4.449

Halpern, D. F. (1999). Teaching for critical thinking: Helping students develop the skills and dispositions of a critical thinker. *New Directions for Teaching and Learning, 80*, 69-74. http://dx.doi.org/10.1002/tl.8005

Halpern, D. F. (2007). *Halpern critical thinking assessment using everyday situations: Background and scoring standards*. Claremont, CA: Claremont McKenna College.

King, P. M., & Kitchener, K. S. (2004). Reflective judgment: Theory and research on the development of epistemic assumptions through adulthood. *Educational Psychologist, 39*, 5-18. http://dx.doi.org/10.1207/s15326985ep3901_2

Kitchener, K. S. (2002). Skills, tasks, and definitions: Discrepancies in the understanding and data on the development of folk epistemology. *New Ideas in Psychology, 20*, 309-328. http://dx.doi.org/10.1016/S0732-118X(02)00012-0

Klein, S., Benjamin, R., Shavelson, R., & Bolus, R. (2007). The collegiate learning assessment: Facts and fantasies. *Evaluation Review, 31*, 415-439. http://dx.doi.org/10.1177/0193841X07303318

Ku, K. Y. L. (2009). Assessing students' critical thinking performance: Urging for measurements using multi-response format. *Thinking Skills and Creativity, 4*, 70-76. http://dx.doi.org/10.1016/j.tsc.2009.02.001

Ku, K. Y. L., & Ho, I. T. (2010). Dispositional factors predicting Chinese students' critical thinking performance. *Personality and Individual Differences, 48*, 54-58. http://dx.doi.org/10.1016/j.paid.2009.08.015

Kuhn, D. (1999). A developmental model of critical thinking. *Educational Researcher, 28*, 16-25. http://dx.doi.org/10.3102/0013189X028002016

Lehmann, I. J. (1963). Changes in critical thinking, attitudes, and values from freshmen to senior years. *Journal of Educational Psychology, 54*, 305-315. http://dx.doi.org/10.1037/h0045302

McMillan, J. H. (1987). Enhancing college students' critical thinking: A review of studies. *Research in Higher Education, 26*, 3-29. http://dx.doi.org/10.1007/BF00991931

Miller, M. A. (1992). Outcomes evaluation: Measuring critical thinking. *Journal of Advanced Nursing, 17*, 1401-1407. http://dx.doi.org/10.1111/j.1365-2648.1992.tb02810.x

Moore, T. (2004). The critical thinking debate: How general are general thinking skills? *Higher Education Research & Development, 23*, 3-18. http://dx.doi.org/10.1080/0729436032000168469

Pascarella, E. T., Blaich, C., Martin, G. L., & Hanson, J. M. (2011). How robust are the findings of Academically Adrift? *Change, 43*, 20-24. http://dx.doi.org/10.1080/00091383.2011.568898

Pithers, R. T., & Soden, R. (2000). Critical thinking in education: A review. *Educational Research, 42*, 237-249. http://dx.doi.org/10.1080/001318800440579

Saarmann, L., Freitas, L., Rapps, J., & Riegel, B. (1992). The relationship of education to critical thinking ability and values among nurses: Socialization into professional nursing. *Journal of Professional Nursing, 8*, 26-34. http://dx.doi.org/10.1016/8755-7223(92)90114-E

Saavedra, A. R., & Saavedra, J. E. (2011). Do colleges cultivate critical thinking, problem solving, writing and interpersonal skills? *Economics of Education Review, 30*, 1516-1526. http://dx.doi.org/10.1016/j.econedurev.2011.08.006

Saiz, C., & Rivas, S. F. (2008). Assessment in critical thinking: A proposal for differentiating ways of thinking. *Ergo, Nueva Época, 22-23*, 25-66.

Saucier, B. L. (1995). Critical thinking skills of baccalaureate nursing students. *Journal of Professional Nursing, 11*, 351-357. http://dx.doi.org/10.1016/S8755-7223(95)80054-9

Shaila, M. Y., & Trudell, B. (2010). From Passive Learners to Critical Thinkers: Preparing EFL Students for University Success. *English Teaching Forum, 4*, 2-9.

Ten Dam, G., & Volman, M. (2004). Critical thinking as a citizenship competence: Teaching strategies. *Learning and Instruction, 14*, 359-379. http://dx.doi.org/10.1016/j.learninstruc.2004.01.005

Tiessen, J. (1987). Critical thinking and selected correlates among baccalaureate nursing students. *Journal of Professional Nursing, 3*, 118-123. http://dx.doi.org/10.1016/S8755-7223(87)80077-7

Tsui, L. (2002). Fostering CT through effective pedagogy: Evidence from four institutional case studies. *The Journal of Higher Education, 73*, 740-763. http://dx.doi.org/10.1353/jhe.2002.0056

Van't Hof, M. A., Roede, M. J., & Kowalski, C. J. (1977). A mixed longitudinal data analysis model. *Human Biology, 49*, 165-179.

Van Houtven, T., Peters, E., & El Morabit, Z. (2010). Hoe staat het met de taal van studenten? Exploratieve studie naar begrijpend lezen en samenvatten bij instromende studenten in het Vlaamse hoger onderwijs. [What about the language of students? Explorative study on reading comprehension and summarizing in incoming students in Flemish higher education]. *Levende Talen Tijdschrift, 11*, 29-44.

Verburgh, A. (2013). *Research integration in higher education. Prevalence and relationship with critical thinking* (Unpublished doctoral dissertation). KU Leuven, Leuven, Belgium.

Verburgh, A., François, S., & Elen, J. (2012). *The development of critical thinking in first year educational sciences students*. Paper presented at European Conference on Educational Research 2012.

Verburgh, A., François, S., Elen, J., & Janssen, R. (2013). The assessment of critical thinking critically assessed in higher education: A validation study of the CCTT and the HCTA. *Education Research International*, *2013*, 13 pages. http://dx.doi.org/10.1155/2013/198920

Verburgh, A., Schouteden, W., & Elen, J. (2013). Patterns in the prevalence of research-related goals in higher education programmes. *Teaching in Higher Education, 18*, 298-310. http://dx.doi.org/10.1080/13562517.2012.719153

Vermunt, J. D. (2005). Relations between student learning patterns and personal and contextual factors and academic performance. *Higher Education, 49*, 205-234. http://dx.doi.org/10.1007/s10734-004-6664-2

Wangensteen, S., Johansson, I. S., Björkström, M. E., & Nordström, G. (2010). Critical thinking dispositions among newly graduated nurses. *Journal of Advanced Nursing, 66*, 2170-2181. http://dx.doi.org/10.1111/j.1365-2648.2010.05282.x

Wood, P., & Kardash, C. (2002). Critical elements in the design and analysis of studies of epistemology. In B. K. Hofer, & P. R. Pintrich (Eds.), *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 231-260). Mahwah: Lawrence Erlbaum Associates.

Yeh, M., & Chen, H. (2005). Effects of an educational program with interactive videodisc systems in improving critical thinking dispositions for RN-BSN students in Taiwan. *International Journal of Nursing Studies, 42*, 333-340. http://dx.doi.org/10.1016/j.ijnurstu.2004.06.008