Fostering post-secondary vocational students' critical thinking through multi-level tasks in learning environments

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Abstract

In today's labour market, being competitive requires, in addition to technical skills, several twenty-first-century career competencies, including the capacity to think critically. Although the literature on teaching methods designed for enhancing students' reflective thinking abounds, the contribution of special tasks with varying complexity to learners' critical thinking capacity, to our knowledge, has not been earlier investigated. Hence, the present investigation sought to investigate the effect of multi-level critical thinking activities introduced into classes on the critical thinking level of post-secondary vocational students. This cross-sectional study employed the Starkey Critical Thinking Test adapted for the Russian-speaking population in order to measure critical thinking level in a sample (n = 218) of vocational students. Results showed that among students whose classes were complemented by critical thinking tasks, almost half of subjects with low and test scores eventually shifted to a medium scoring cohort. Eleven learners who were medium scorers at the beginning gained high-level results at the end point. Meanwhile, only a small percentage of those no-treatment participants with initially low performance on the critical thinking test eventually moved into the medium level, as well as from the latter into a high achievement category. The independent two-tailed t-test revealed a significant difference between posttest scores observed in control and intervention groups. It can be therefore suggested that critical analysis of thought-provoking materials with subsequent class presentation and discussion can provide catalytic conditions for developing learners' reflective thinking abilities. It was recommended that future studies using similar intervention should involve a larger sample and deal with qualitative data to extend the research and increase its validity.

Keywords: Education; higher-order thinking; reflective thinking; vocational students.

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1. Introduction

1.1. Background

In the current era of increasing information flow, learners who wish to succeed in the job market must be able to navigate the plethora of resources, being conscious of which information is useful, unnecessary or misleading. They should be able to find the data they need, prioritise and organise it, distinguishing facts from opinions, recognizing alternative facts and misinformation, and countering them argumentatively. Moreover, a major challenge for students in the 21st century is to acquire the capacity to think critically. This assumedly means being able to achieve judgment after the alternatives have been scrutinized, respecting the arguments and evidence available (Vieira & Tenreiro-Vieira, 2016). In other words, to think critically means to grasp information, examine it rigorously, subject it to scepticism, compare it with opposing views and with what is already known about the topic, and only then take a stance on the matter. Critical thinkers also must possess capabilities to examine new ideas from multiple perspectives, make judgements about the credibility and value of information, and assess the relevance of new information to their needs (Flores et al., 2012; Loes & Pascarella, 2017).

Despite academic literature exuberates with scholars' attempt to define what critical thinking is (Cáceres et al., 2020; Dekker, 2020; Heidary, 2020; Nurhakim et al., 2021), a clear understanding of this term has still been muddled. Because of that, uncertainty surrounds the concept and purport of critical thinking and it is almost invariably looked at in an intuitive way. Moore (2013) scrutinised a plethora of works that address the notion of critical thinking and interviewed academics from a variety of disciplines. Eventually, seven ways to see critical thinking were inferred: as a form of self-reflexiveness, as the making of judgements, as a skeptical view of knowledge, as the building up of knowledge, as a careful reading of text, as a form of rationality, and as an activist engagement with knowledge. It appears inevitable to deal with such a multifaceted concept.

In today's labour market, being competitive requires, in addition to technical skills, several twenty-first-century career competencies (for a review of the 21st-century skills, see van Laar et al., 2020), among them the capacity to track skills and values relevant to the current job market, as well as the ability to reflect on what opportunities a particular job offers and make appropriate career decisions (Meijers et al., 2017; Darling-Hammond et al., 2020). Obviously, such competencies call for critical thinking. Meanwhile, some studies claim students nowadays show quite low critical thinking levels (Deechai et al., 2019; Palavan, 2020). Education institutions thus need to shape learning environments conducive to the cultivation of those vital skills, including critical thinking. Unfortunately, even in such advanced countries as Sweden, vocational education is reportedly often centred on labour skills required to execute certain tasks in a workplace, although positive shifts have been observed in that area (Rönnlund et al., 2019).

Among techniques that educators have employed in order to develop students' critical thinking are blogging (Lee, 2011), simulation (Eyikara & Baykara, 2017), case-study learning (Straková & Cimermanová, 2018), and flipped classrooms (Yavuz & Ozdemir, 2019). In particular, the use of problem-based learning has recently been reported to improve several critical thinking skills of vocational students significantly (p<0.001) relative to their counterparts taking a standard vocational course (Suarniati et al., 2019). The authors attribute this to experimentally applied learning activities directed towards the building of students' analytical and communicational capacities.

Nevertheless, the scientific literature provides some sobering evidence. El Soufi and Sea (2019) conducted a systematic review of nearly two thousand studies describing the impact of sundry methods (like brainstorming techniques or self-evaluation) supposed to foster critical thinking skills of higher education students learning English as a foreign language. The authors examined the quality of the papers

through the Sieve tool with a scale from zero to five, where a higher value means a higher quality of research. Even though almost all included studies reported positive experimental outcomes, none of them received more than two points due to various deficiencies in their design. The authors, therefore, came to the conclusion that it was impossible to confidently assert the effectiveness of any of the experimentally assessed methods for developing critical thinking among English language learners in higher education.

1.2. The importance of the research

Although the literature on teaching methods designed for enhancing students' reflective thinking abounds, the contribution of special tasks with varying complexity to learners' critical thinking capacity, to our knowledge, has not been earlier investigated. The present study could thus improve our understanding of whether classroom activities may be conducive to the improvement of students' critical thinking capabilities, adding to the existing body of literature about the subject.

1.3. The purpose of the research

Hence, this cross-sectional study sought to determine whether significant differences in critical thinking existed between students whose classes were complemented by critical thinking activities and those exposed to a non-remodelled course.

2. Methods

2.1. Sample and procedure

This experimental quantitative research took place over the period between September 2018 and May 2020. The participants (n = 218) were voluntarily involved female and male students of several technical and vocational education and training programmes at the Saken Seifullin Kazakh Agrotechnical University in Kazakhstan. The span of the participants' age was between 17 and 19. The subjects were selected according to available sampling. There were a control group (n = 110) with no interference in the educational course and an intervention group (n = 108) that was given multi-level tasks (Figure 1) supposed to engage students in higher-order thinking through the critical analysis of popular science articles proposed by a teacher (the research team member) with subsequent class presentation and discussion. An example of a critical-thinking task can be seen in Appendix. In the 2018/2019 academic year two classroom hours per week were allocated to reading, analysing and discussing the instructional materials, whereas in the 2019/2020 academic year one classroom hour per week was devoted to the experimental activities. Ultimately, a total of 90 classroom hours were assigned to the intervention. The students predominantly worked in groups with a teacher guiding and facilitating the process by leading discussions on topics, giving question prompts, and so forth. Due to the COVID-19 pandemic, critical thinking activities were carried out remotely through the Platonus platform starting from March 2020.
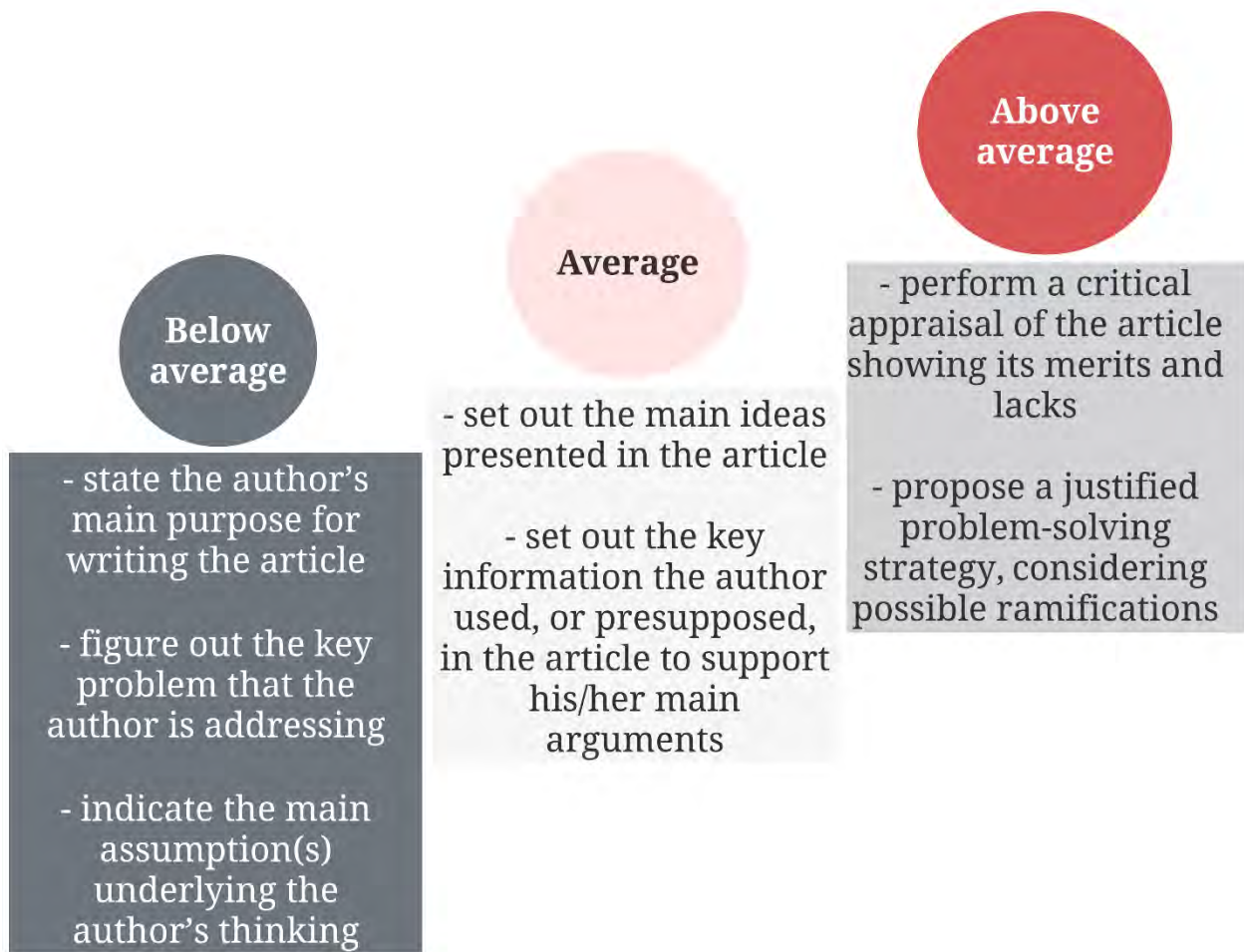
Below average

- state the author's main purpose for writing the article

- figure out the key problem that the author is addressing

- indicate the main assumption(s) underlying the author's thinking

Average

- set out the main ideas presented in the article

- set out the key information the author used, or presupposed, in the article to support his/her main arguments

Above average

- perform a critical appraisal of the article showing its merits and lacks

- propose a justified problem-solving strategy, considering possible ramifications

Figure 1. The gradation of complexity of tasks used to develop vocational students' critical thinking

2.2. Data collection and analysis

To examine whether there was any effect of the intervention on the students' critical thinking, the Starkey Critical Thinking Test adapted for Russian-speaking individuals from its original English version was given to both groups as pretest and posttest. The adapted test is reduced from thirty to twenty-seven four-option questions which are formulated more concisely as compared to the original test. Moreover, there is a 30-minute time limit in the adapted version. The author reported the test-retest reliability of 0.74 ($P<0.001$), Ferguson's discrimination index of 0.97, Cronbach's alpha of 0.71, and the item difficulty between 0.28 and 0.85 with a mean of 0.54 (Lutsenko, 2014). The text in the original language can be consulted, for example, in a paper by Husna (2019).

The study protocol was approved by the ethics committee at the Saken Seifullin Kazakh Agrotechnical University (approval number 1437-RM). Besides, all the individuals provided informed consent to be involved in the experiment.

Between-group differences were analysed through an unpaired two-tailed t-test at a 0.05 level of significance encompassing residual diagnostics checking for a possible violation of the normality

assumption. No violations were detected. The procedures were performed by means of GraphPad Prism 9 for Windows (GraphPad Software, San Diego, California, USA).

3. Results

As depicted in Figure 2, the critical thinking pretest found no significant difference between the experimental group and the comparison one (t(216)=0.357, p=0.722). Neither very low-level scores (less than 7) were obtained from pretest or posttest, nor were those designated as of very high level (more than 25).
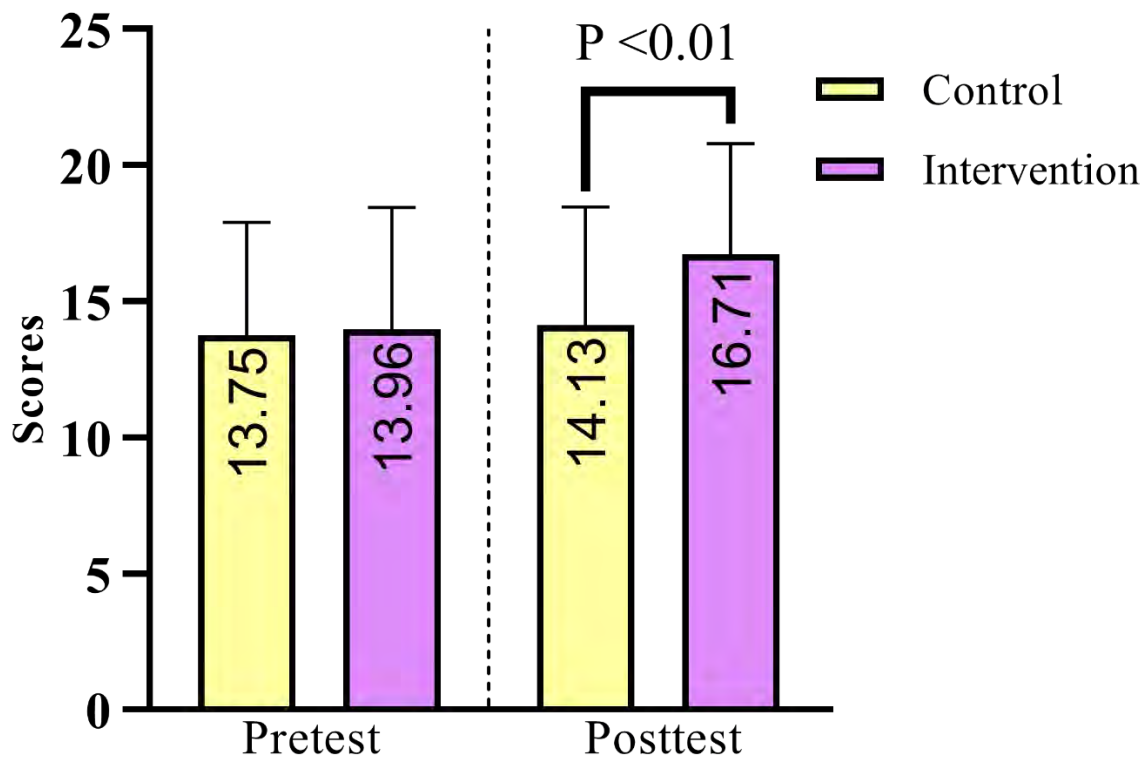

Figure 2. Results of the Starkey Critical Thinking Test among vocational students presented as means and their standard deviations

Figure 3 provides an itemized overview of the transitions in students' critical thinking performance from one level to another across the experiment. Thus, it can be seen that in the control group only a small percentage of participants with initially low (7-10 scores) performance on the critical thinking test eventually moved into the medium level (11-20 scores), as well as from the latter into a high achievement category (21-25 scores).
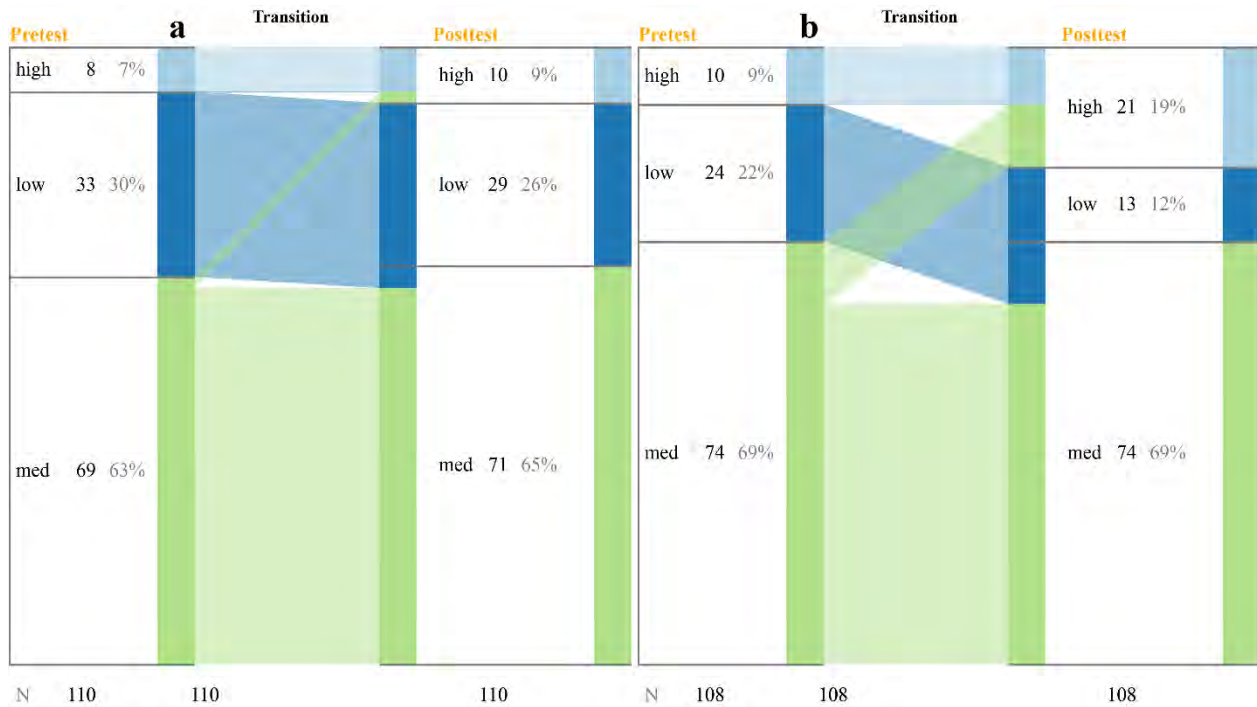
Figure 3. The transitions of vocational students' performance on the Starkey Critical Thinking Test between pretest and posttest phases in the control group (**a**) and the intervention group (**b**)

Meanwhile, almost half of individuals in the experimental group with low test scores shifted to a medium scoring cohort upon completion of the intervention. Furthermore, eleven students who were medium scorers at the beginning of the research ultimately gained high-level results. As is evident from Figure 2, there was a significant difference between posttest results in control and intervention groups (t(216)=4.530, p=0.000).

4. Discussion and conclusion

Critical thinking has been around for 2,500 years and it draws its source from the philosophical trend promoting standards of thought anchored to the ideas of ancient thinkers (Socrates, Plato, and Aristotle) and their medieval and modern followers (Fahim & Masouleh, 2012). Despite there is no unitary definition for critical thinking, it is generally considered the ability to assess the reasoning and identify fallacious arguments (Song, 2016). Some academics extend the concept of critical thinking beyond the traditional emphasis on judicious evaluation of relevant statements, advocating that critical thinking also requires non-cognitive skills, including a proclivity for such systemic intellectual operations (Shaw et al., 2020). Furthermore, Bishara (2021) describes critical thinking as the ability to evaluate an intellectual product.

As already noted above, the impact of the use of multi-level tasks on learners' critical thinking capacity has not received considerable attention in the literature, so our findings filled this gap and can be put into practice. The findings could be combined with those of Hashemi and Ghanizadeh (2012), who claimed a beneficial influence of critical discourse analysis of journalistic materials with follow-up presentations made by post-secondary students on their reflective thinking skills.

The results obtained from the present study might have implications for institutions planning to apply analysis and reflections on sundry thought-provoking texts along with spoken interactions to cultivate learners' critical thinking abilities. With regard to the aspect of cooperation, a structural equation modelling analysis (Lu et al., 2021) proved that, inter alia, students' peer interactions had a direct impact on college students' higher-order thinking skills. Nonetheless, interpreting results of her study involving undergraduate students in computer-mediated communication via blogging and face-to-face interaction modalities, Lee (2011) judged that asynchronous communication emerged to be favourable for improving participants' critical thinking abilities due to the provision of more time to reflect on their ideas.

New Zealand scientists conducted a study on undergraduate students enrolled in a management course that included critical analysis and communication performed through small group tutorials along with class lecture/workshops with follow-up semi-structured interviews that incorporated problem-solving tasks (Phillips & Bond, 2004). The authors characterized the outcome as disappointing, inferring the inadequacy of integrating critical thinking activities in education for generating that quality in line with employers' demands.

However, several empirical studies have concluded that honed critical thinking tends to benefit the academic achievement of learners, including college students (Hohmann & Grillo, 2014; D'Alessio et al., 2019). Having undertaken a longitudinal correlational research on nursing students, Pitt et al. (2015) came to illation that high-level critical thinking is a momentous contributory factor towards students' academic performance. The findings set out herein could therefore have practical implications for instructional programs aimed at better learners' academic outcomes by fostering their critical thinking.

It was argued that aside from refining their capability to fulfil reflective thinking operations and tasks, learners also should ideally have a propensity for executing the skills, and even more, they should be performed regardless of contexts, domains, and disciplines (Bunt & Gouws, 2020). That is particularly pertinent given that critical thinking is mentioned among generic competencies related to a wide context of professional development (Gamble, 2016). In the meantime, Spector and Ma (2019) hypothesize that this is only possible under conditions of goal-oriented behaviour and strong self-regulatory mechanisms. Hopefully, students' capacity to process information critically fostered through text analysis and discussion praxis might be translated for novel challenges and broaden real-life contexts beyond classroom activities. For instance, vocationally trained workers can transfer the approach of applying critical thinking into their professional activities and career. On the other hand, a link was revealed between critical thinking level and self-regulation (Ghanizadeh, 2011).

Although objectives and approaches existing in vocational education are different from those of tertiary education, some scholars believe in the prospects of building such models of teaching, which could ensure equipping students with both job skills and higher-order thinking skills (Ismail, 2013; Ismayati et al., 2020). The current study, in particular, may further inform curriculum development strategies and thereby contribute to the shift towards a learning model that enhances reflective thinking.

As for the limitations of this investigation, the main one is the lack of qualitative data gathered through interviews and alike. Besides, it deals with a relatively small sample recruited from one institution, so generalization of the findings is hardly applicable. Thus, future research is encouraged to address these shortcomings.

Overall, the results of the present study indicate that vocational students exposed to multi-level tasks aimed to propel the development of their critical thinking were found to outperform their counterparts engaged in conventional classes on the critical thinking outcome measure. This offers probabilistic evidence that critical analysis of various thought-provoking materials with subsequent class

presentation and discussion can provide catalytic conditions for developing learners' reflective thinking abilities.

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Appendix

Карточка – разноуровневых заданий 4.1
Объект изучения: Воля человека и психология саморегуляции

Уровень сложности	Задание	Балл	Методы, форма работы
Третий уровень (сложный)	Сформулируйте рекомендации по проблеме профилактики и преодоления стресса студенту вуза		Модель, программа
Второй уровень (средний)	Определите факторы (положительные и отрицательные), влияющие на протекание стресса у человека	70-80%	Системный анализ
Первый уровень (легкий)	Определите причинно-следственные связи стресса (прямые, опосредованные, простые и сложные)	50-60%	Рыбный скелет

Appendix. An example of a task used by the research team to develop vocational students' critical thinking (in Russian)