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Working memory refers to a kind of system to process cognitive information, store visuospatial and verbal information, and perform central executive. It is thought to be the core of activity, and it is the important component of learning, reasoning, problem-solving, and intellectual activity (Barrouillet, et al., 2008; Camos, 2008; Kingberg, 2009; Zhao & Zhou, 2010). General intelligence has two important factors which are crystallized and fluid intelligence (Cattell, 1971). Crystallized intelligence (Gc) is thought to reflect skills acquired through knowledge and experience and is related to verbal ability, language development and academic success (Cattell, 1971; Kline, 1998; Deary et al., 2007). Fluid intelligence (Gf) refers to the ability to reason and to solve new problems independently of previously acquired knowledge that influences learning in everyday life in both professional and educational settings (Kingberg, 2009; Jaeggi et al., 2008; Perrig et al., 2009; Alloway, 2009). Gf is critical for a wide variety of cognitive tasks, and it is considered one of the most important factors in learning (Jaeggi et al., 2008). Moreover, Gf is closely related to professional and educational success, especially in complex and demanding environments (Jaeggi et al., 2008). Although there is evidence that Gc can be improved through memory training in improving acquired skills, such as Gc and academic attainment, has to be established (Alloway, 2009), nevertheless, Gf has closer correlation with working memory. Many researchers have discussed the problem of correlation between working memory training and Gf, therefore, this essay will briefly review the correlation from two perspectives: positive influence and some disadvantages.

1. Training of working memory positively impacts the Gf.

First, working memory training can improve working memory capacity. Working memory capacity closely linked with fluid intelligence is the most critically underlying Gf determiner, it is one of the principal bottlenecks, and it is fundamental to our ability to dual-task and to how well we are able to shut out distracting information (Kingberg, 2009). People with higher working memory capacity often in daily life wander less to during challenging tasks requiring attention and effort (Kane et al., 2004). Halford et al. (2007) proposes that working memory and intelligence share a common capacity constraint. Therefore, it is plausible that the training of a certain neural circuit might lead to transfer on other tasks that engage similar or at least overlapping neural circuits (Kane & Engle, 2002). Some studies have demonstrated that working memory training can not only improve working memory capacity, and has greater improvement at problem-solving and reasoning, but can also transfer and lead to effects that go beyond a specific training effect (Jaeggi et al., 2008; Kingberg, 2009).

Second, working memory training can improve IQ scores. Some studies have shown that reasoning capacities can be enhanced in this population (the hell, WHAT POPULATION) especially for those underestimated by IQ (Hessels-Schlatte, 2002; Hessels & Hessels-Schlatter, 2008). Some studies have demonstrated the results that working memory training can improve IQ scores. For instant, Kvashchev's experiment (Lazar, 1986) illustrates that there is an improvement of 7.8 IQ points in their subjects. The group that has received the special training improved their mean performance by roughly 10 percent (Hallowell, 2005). A controversial study has shown that training with a working memory task (the dual n-back task) improves performance on a very specific fluid intelligence test in healthy young adults. The finding that cognitive training can improve Gf is a landmark result because this form of intelligence has been claimed to be largely immutable. Instead of regarding Gf as an immutable trait, the data provide evidence that, with appropriate training, there is potential to improve Gf (Jaeggi et al., 2008, they find the groups with 17 and 19 days of training show an increase of performance of 40%).

Third, elder people with lower cognitive performance capacity also show near and far transfer effects after working memory training. Buschkuehl et al. (2008) indicate that they are able to demonstrate near transfer to visual working memory and far transfer to visual episodic memory after working memory training in 80-year-olds. The subjects were trained for 13 weeks, twice a week, for about 15 minutes with working memory tasks in a group setting. Both tasks were adapted after each trial to the individual performance level. Thus, there is evidence that elderly subjects with lower cognitive performance capacity also show near and far transfer effects after training. A recent study by Li et al. (2008) presents findings that indicate larger near transfer effects in the older adults (70–80 years) than in the younger adults (20–30 years).

Fourth, working memory training can improve persons with intellectual disabilities performance. It is well known that impairments of working memory processes are strongly associated with several neurodevelopmental disorders, such as Down syndrome, Williams syndrome, specific language impairment, and general intellectual disability (Gathercole & Alloway, 2006; Jarrold et al., 1999; Van der Molen et al., 2007). Small increases in the efficiency of working memory may significantly improve performance in general, maybe especially in persons with intellectual disabilities in educational settings and in their daily lives (Perrig et al., 2009). Working memory deficit is thought as one of the crucial cognitive deficiency of alcohol spectrum disorder in children (Rasmussen, 2005). Loomes et al. (2008) conducts working memory training of strategy; the result shows that the span of language working memory in children in experimental group improves significantly; moreover, the children in experimental group adopt more rehearsal strategy.

Fifth, working memory training can improve children with ADHD (attention deficit/hyperactivity disorder) reading performance and visuospatial tasks. ADHD also is associated with abnormalities in the frontal lobe (Schweitzer et al., 2000). Klingberg (2009) uses an intensive and adaptive training of working memory with children with ADHD. The result shows that training significantly enhances performance on the trained working memory tasks, and thus performance on RAPM (Raven's Advanced Progressive Matrices) was significantly improved by 26% (MRKNI NA ORIGINÁL – je to o 26% nebo u 26% pacientů??) in the experimental group. Buschkuehl et al. (2008) have pilot study for ADHD, the result is shown that the ADHD children who improve in the training task show significantly higher gain scores in the nonverbal intelligence test than the children who do not improve in the training task and the control group.

2. Some disadvantages of working memory training

First, the training content of working memory is a little chaotic; is it difficult to clarify what is the content of training (zhao & zhou, 2010)? There is a phenomenon that different researcher adopts different methodology in a study about working memory training. For instance, someone adopts visuospatial tasks of working memory, digital span tasks, and language span tasks as the tasks of working memory training (Klingberg, 2009). Someone adopts rehearsal strategy of working memory training (Lee et al., 2007; Naumann et al., 2008). Someone adopts "n-back" tasks of working memory training (Jaeggi et al., 2008). Working memory is a kind of importantly cognitive ability that owns complex structure. Therefore, which aspects of working memory training do they obtain by these tasks? Maybe, this is a problem.

Second, there is a viewpoint which thinks some studies as owning small samples. For example, Perrig et al. (2009) suggest that generalization of these findings is obviously problematic because of the small samples.

Third, the studies about working memory training are still in the phase of probe, many experimental designs are not very rigorous, the control of process is not enough for training, for example, experimenter effect and placebo effect do not get good controls (zhao & zhou, 2010). Shipstead et al. (2010) points out that working memory training studies are plagued with poor experimental design. The majority of training studies utilize a no-contact control group making it impossible to determine whether any benefit of training is due to actual improvement or a Hawthorne effect. They concluded that, as of yet, the results are inconsistent and this is likely driven by inadequate controls and ineffective measurement of the cognitive abilities of interest.

Fourth, severe intellectual disabilities are extremely difficult to improve their seasoning and intellectual function. Many practitioners working with persons with moderate to severe intellectual disabilities certainly will agree that it is extremely difficult for these individuals to go beyond a concrete level of reasoning and to improve their intellectual functioning. Among the scientists working in the area, some take the pessimistic side of argumentation (Jensen, 1969).

Fifth, some studies are lacking external validity, transfer is relatively difficult. Performance on trained tasks can increase, transfer of this learning to other tasks or domains remain shockingly rare (Jaeggi et al., 2008). In fact, while the literature on cognitive training demonstrates impressive improvements in the trained tasks, evidence for transfer to nontrained tasks or functions is rare (Healy et al., 2006).

Sixth, some researchers think the conclusion from Klingberg et al.'s research is far from undisputed. A neutral article will necessarily have to detail the arguments of the other side as well, and do this in a neutral way. The article is written almost completely by a user named "Cogmed", which is also the name of the company selling Klingberg's software (viewpoints retrieve from wikipedia).

On all accounts, working memory training is very useful to human. Due to study in a preliminary phase, some problems need to continue to be analyzed and solved, some methods need to be appropriately, rigorously and precisely used, the process of study needs to notice the rigor.

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