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SLEEP HABITS AND BIOGRAPHICAL LEARNING. A REVIEW OF PREVIOUS RESEARCH ON THEIR CONNECTIONS

Does a perfect sleep contribute to biographical learning? There is a strong possibility that it does. We know from our experience that real sleep is needed before any activity, such as performing important work tasks, or taking examinations, or making conference presentations, or taking part in sports competitions and so forth. However, some people may think that it does not matter, that sleep is not so important, that many adults can do well without much sleep. Regardless, if you do not get enough sleep at night, you can always catch up the following night or nights, as many of us believe. But this, unfortunately, is not as simple as it sounds and could be quite misleading. "The shorter your sleep, the shorter your life span" (Walker 2017, p. 4).

What are the conditions for biographical learning? Is a good night's sleep one of them? Are sleep and rest included in these conditions? What about sleeping habits when we get older, and what about our biographical learning? How can they be related? These are some questions I want to address and discuss in this article.

Some myths about adults learning and sleep

Adults' ability to learn in everyday life have been questioned for a long time by psychologists, educationists as well as ordinary people. In the past, learning and education were associated primarily with children and young people. As adults, it was firmly believed that we were already developed and fixed for life. This mainly meant formal learning, as no other form of learning was taken into consideration. When psychology as a scientific discipline developed at the beginning of 20th century, the phenomenon of learning was treated by research and theory entirely as pertaining to children and young people both by developmental as well as cognitive psychology. This was not different in people's minds either, although experience perhaps proved otherwise. But even today the proverb that "You cannot teach an old dog new tricks" is occasionally quoted. At the same time, this is a deep-rooted saying, and today some people still believe it is

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true. Everyday life experience is quite different, there may be substantial differences between individuals regarding difficulties or success with learning, sometimes due to their age. Among adult educationists and educators, a prevailing belief is that we have the potential to learn even during older age. The healthier you are the more learning capabilities and opportunities to learn new things you have.

The second myth is much more complicated. "Adults and especially older adults need less sleep". The majority believe that as we age we do not need to sleep as long and that the quantity and quality of sleep are not related to learning. This belief, according to Walker, a neuroscientist, has stemmed from certain observations by some scientists suggesting that an eighty-year old simply needs less sleep than a fifty-year-old (Walker 2017, p. 103). Leitz (2007, p. 230), a social work researcher, writes, referring to various specialists, "Sleep needs vary among individuals, but a range of 4 to 8 hours of sleep a night is considered necessary for normal functioning". However, Walker and his team, being seriously involved in research for several years, challenge this statement. He writes that "…just because an older individual obtains less sleep or does not obtain as much recovery sleep after sleep deprivation, does not necessarily mean that their need for sleep is less. It may just as easily indicate that they cannot physiologically generate the sleep they still nevertheless need" (Walker 2017, pp. 103-104). According to Leitz (2007, pp. 230-31), and without any disagreement on this matter, "sleep is easily disturbed by many different physical and emotional problems". Older people face more problems that are associated with sleep. "Approximately 50% of individuals 60 years old report chronic sleep problems, and 100% of those who are 90 and older experience sleep disturbances". But, then again, Walker (2018, p. 104) continues that: "older adults, may, in fact, need more sleep than they themselves naturally generate, since they benefit from an improvement in sleep quality, albeit through artificial means".

The research on sleep has intensified recently, but still too few people know about the results and especially about its possible impact on learning.

Learning, sleep and autobiography

Sleep, as a phenomenon, has never been studied by adult educationists. But it seems obvious from neuroscience research that we learn during sleep. Perhaps we can learn more from neurobiology and neuroscience about how our brain and our sleep affects learning. Some examples, as far as the role of brain development and our narrative competence are intervening, but not necessarily in connection to sleep, can be found in Horsdal's (2011) research. In addition to neuroscientific studies, sleep is a subject for gerontologists and social workers (see Leitz 2007) as well as for psychologists. A group of Swedish psychologists with Aleksander Perski, dealing with stress, studied

the relation between sleep and stress. One finding concerns the necessary amount of sleep which predicts burnout (Söderström et al. 2012): "…insufficient sleep, preoccupation with thoughts of work during leisure time, and high work demands are risk factors for subsequent burnout. The results suggest a chain of causation" (Söderström et al. 2012, Abstract).

Referring to the brain function Siegel (1999, p. 330) emphasizes "This mapping process may be at the heart of autobiographical narrative and the way the mind attempts to achieve a sense of coherence among its various states: trying to make sense of the self in the past, the present and the anticipated future. We can propose that the capacity of the mind to create such a global map of the self across time and various contexts – to have autonoetic consciousness – is an essential feature of integration that may continue to develop throughout life". Autonoetics comes from autonoesis and means self-knowing.

Today some older adults are healthier, live longer, have better nutrition habits and are physically more active than in the past (see Leitz 2007; Perski 2016). All that might contribute to their abilities to learn for as long as they live. However, while we can see some progress in learning even in older adults, can we see any benefits of longer sleep? Some may say, and without taking the age factor into consideration, that to make a decision straight away is not always advisable as "you'd better sleep on it".

There is obviously a relationship between having less sleep and a medical condition among older adults. Similarly, the reverse can be true: the medical condition generates less sleep. However, according to Walker, "individuals fail to connect their deterioration in health with their deterioration of sleep" (Walker 2017, p. 96). In this article, I will claim, with the support of research, that the view on longer sleep as a contribution to better learning has changed in recent years.

What do we know about sleep?

Sleep was seen wrongly, as a passive rest for the brain to "recharge one's batteries". This is not entirely true, as today neuroscience can prove what kind of processes occur in our brain, how the brain is both developed and maintained while we are asleep and how this is affected by the quality and quantity of sleep. However, sleep is not homogenous, but rather consists of different stages. In 1952, two American researchers, Klaitman and Aserinsky discovered that we cycle through two completely different types of sleep: NREM sleep, i.e. no-rapid eye movement and REM sleep, i.e. rapid eye movement (see Walker 2017). These two stages are involved in a battle to dominate the brain throughout the night. Every ninety minutes is first ruled by NREM-sleep which is followed by the coming of REM sleep. Walker presents the figure of Sleep's Architecture built on two axes; vertical showing the stages of sleep, and horizontal referring to the duration of

night which is divided into 90-minute cycles. Each cycle includes wake, NREM stage 1, stage 2, stage 3 and 4 (slow wave sleep) and REM. The whole duration of sleep lasts from 11PM to 7AM (Walker 2017, p. 43).

Sleep is crucial for the development of our brain. "Numerous functions of the brain are restored by, and depend upon, sleep. No one type of sleep accomplishes all. Each stage of sleep – light NREM sleep, deep NREM sleep, and REM sleep – offer different brain benefits at different times of night. Thus, no one type of sleep is more essential than another. Losing out any one of these types of sleep will cause brain impairment" (Walker 2017, p. 106). Thus, sleep is essential for our development as humans and for learning. "REM sleep is crucial for memory consolidation and has been suggested to facilitating long-term potentiation, allowing the strengthening of synaptic connections" (Siegel 1999, p. 53).

REM sleep was fundamental to making us human during our early development and contributed to our sociocultural complexity. What is more, REM sleep had an impact on our cognitive intelligence and emotions. Through this kind of sleep, we developed and increased our ability to recognize and navigate successfully the range of socioemotional signals that are located in human culture, like facial expressions, both covert and overt, bodily gestures, language and how a group behaves. REM-sleep enhanced the ability of emotional IQ to emerge and in the end contributed to the creation of strongly, emotionally clever, and highly bonded social communities of humans. Another quality of REM sleep dreaming was its impact on creativity (Walker 2017). Walker points out that "the harder we worked those increasingly developed emotional and creative circuits (*paths,* AB explanation) of the brain during the day, the greater was our need to service and recalibrate these ever-demanding neural systems at night with more REM sleep" (Walker 2017, p. 76).

NREM and REM play a crucial part here; while the first helps transfer safely newly learned facts and data into the long-term storage of the brain, the latter takes on newly gained memories to put them together and include in the entire catalogue of our life's autobiography. The REM sleep constructs huge associative networks of information within our brain. Interestingly, REM sleep can take a step back, and intuitively discover the network's core. Thus, the brain is not passive during sleep at all, just the opposite; it is actively, but unconsciously, engaged in making sense of newly obtained information linking it with old information to the whole. "We can awake the next morning with new solutions to previously intractable problems or even be infused with radically new and original ideas" (Walker 2017, pp. 75-76). This is exactly how sleep might relate to learning, and our biographical learning; we can make sense of our lives with the help of dreaming, i.e. REM sleep, during the night.

So, what happens when the brain is involved with consolidating our experiences and memory, and what about sleep disturbances? Siegel notes:

"… the brain is a complex system, meaning that there are multiple layers of component parts capable of chaotic behavior. These parts can be conceptualized at various levels of analysis and include the single neuron and its sending and receiving functions; neuronal groups; circuits; systems; regions; hemispheres; and the whole brain. The basic components, the neurons, are the simplest" (1999, p. 17).

He describes the function of the brain by showing how the brain is organized. "As … the brain as an open system, each region of the brain may take in unique input from outside of itself", but the task still is integration (Siegel 1999, p. 8-10).

To sum up, neuroscientists see sleep, especially REM sleep, as a factor forming us, and our accomplishments, as unique humans. Walker compares sleep with language development or discovering and using tools. More than that, sleep shaped both these latter fundamental features of humankind. This is an important conclusion which shows how crucial sleep might be for learning (language, problem solving and actions), and thus for our development as humans. It also leads us to ideas about how we can learn to change our habits of sleep when we get older and make these habits important.

Changes in sleep during our lifespan

Sleep is essential for growing and developing as a child and a teenager, considering both physical, mental, as well as emotional conditions. Although the sleep cycles remain the same, their stages differ in their proportions, what is more, sleep becomes shorter when we become older. When coming to this stage, adults usually face sleep difficulties, as they obtain a lesser amount of sleep compared to young persons. Additionally, "the older the individual, the more disrupted the REM sleep … even if the individual is in good health" but "medications to treat … illnesses decrease REM sleep even further" (Leitz 2007, p. 233). Overall, among older people, the length and quality of sleep decreases because of changes in sleep patterns, with longer periods of the lighter stages and shorter periods of the deeper stages of sleep.

The core deficiencies of sleep that occur with aging are, first, declines in the quantity and quality of sleep, second, the reduction of sleep efficiency, and finally, the disordered timing of sleep. If we look at the first deficiency, "there is a palpable reduction in the electronical quantity and quality of deep NREM sleep", which means that there are "few hours of deep sleep, and the deep NREM brainwaves become smaller", fewer in numbers and are not so powerful (Walker 2017, p. 96). This happens gradually, and unfortunately, when people are facing seventy years of age they lose 80 to 90 percent of their former deep sleep. However, older adults do not have any recognition of this

quality of sleep. They are, according to Walker, "not fully realising how degraded their deep-sleep quantity and quality have become". This means that senior "individuals fail to connect their deterioration in health with their deterioration with sleep, despite causal links between the two having been known to scientists for many decades" (Walker 2017, p. 96). This also concerns GPs (General practitioners) who seldom think about sleep as a cause of poor health or its worsening. However, Walker adds, "to be clear, not all medical problems of aging are attributable to poor sleep. But far more of our age-related physical and mental health ailments are related to sleep impairment than either we, or many doctors, truly realise or treat seriously" (Walker 2017, p. 96).

The second change in the sleep flow is its fragmentation. This is caused by many factors such as medication and diseases, but most seriously, by a weakened bladder, i.e. older adults more frequently make visits to the bathroom, which causes the efficiency of sleep to suffer. Being in bed for 8 hours and sleeping for all those hours gives 100 percent efficiency, while sleeping only four hours gives only 50 per cent (Walker 2017, p. 96).

When we get older, the third change in our sleep habits concerns circadian timing, which can be in sharp contrast to young people. Commonly, seniors experience a regression in sleep timing which leads them to earlier and earlier bedtimes. Our earlier start time for sleep when we get older is caused by an earlier evening release and peak of melatonin (Walker 2017). Melatonin, in other words "the hormone of darkness", is a suprachiasmatic nucleus that communicates repeating signals of night and day to our brain and body (Walker 2017, p. 22). It signals, systematically, darkness to the organism and the time to go to bed. What is even worse "the strengths of the circadian rhythm and amount of night-time melatonin released also decrease the older we get" (Walker 2017, p. 99).

As Leitz (2007) writes, circadian rhythms regulate sleep-wake cycles, which as such are regulated by exposure to light. Circadian rhythm disturbances can be treated in a suitable way by using light therapy. Poor sleep and lack of sleep have destructive impacts on one and all, although especially on seniors. Among the elderly, sleep disorders are more frequent "and escalate in intensity and frequency due to deterioration of physical and psychiatric status that occurs with normal aging" (Leitz 2007, p. 230). Lack of sleep causes health problems as well as reduced energy, emotional instability, humour fluxes, concentration inability, and what is more, it has a destructive impact on personal relationships. "Individuals who do not receive adequate sleep have higher rates of illness" (Leitz 2007, p. 230). Common problems for older adults are anxiety and depression. They are caused by experiencing major losses, i.e. the death of a spouse or family members, "loss of home and independence", and of course, lifestyle changes due to financial problems (Leitz 2007, p. 230). As life expectancies get longer, seniors

have to support themselves financially for many years, as they live for another 25 to 30 years after retirement. They are also likely to be healthier and remain active, but "the older they are the more likely they are to have health problems" (Leitz 2007, p. 231).

Experiencing a lack of sleep and its bad quality contributes not only to illness but also might affect our ability to learn. Neuroscientists have demonstrated "how critical deep sleep was for cementing new memories and retaining new facts in young adults" (Walker 2017, p. 102). When young adults were compared with seniors, the latter differed by almost 50 per cent in ability to memorise and learn new things. The older adults "with the greatest loss of deep sleep showed the most catastrophic overnight forgetting. Poor memory and poor sleep in old age are therefore not coincidental but rather significantly interrelated" (Walker 2017, p. 102). Forgetting in other words is caused by sleep that is disturbed and too short. Important experiences learned during daytime might be lost while the new configuration of old and new, even if fragmented memory bits, need to be consolidated (Siegel 1999). Another discovery relates to Alzheimer's disease: "It is important to note, that the extent of brain deterioration in older adults explained 60 per cent of their inability to generate deep sleep". Thus, Walker argues for "an urgent need (…) to develop new methods that restore some quality of deep, stable sleep" in older adults (Walker 2017, p. 103).

What seems interesting, concerns the importance of deep sleep for learning and memory in any age; not to mention some other important functions of health and of bodily condition. What happens when we sleep the night after learning? Sleep protects newly acquired information and knowledge, affording immunity against forgetting, i.e. our ability to consolidate the new with the old. Dreaming can be seen as a creative incubator, since "sleep is constantly modifying the information architecture of the brain at night (…) even daytime naps as short as twenty minutes can offer a memory consolidation advantage, so long as they contain enough NREM sleep" (Walker 2017, p. 115). While NREM sleep declines in old age, the ability to learn and maintain memory can also be diminished.

Interestingly, while sleeping after learning allows us to remember, we can also forget. Thus, we pay a price for remembering by forgetting. Still, the ability to forget can be as important as the need for remembering, writes Walker. Sleep is more intelligent than it seems by "deciding" what is important, and what is irrelevant to remember. Thus, brain function is crucial. We commonly think that it is something like 'muscle memory", but in fact, according to neuroscientists, this memory routine when we train and strengthen muscles is steered exclusively by the brain. So, what do we know about learning, and what can be a possible connection to sleep?

What do we know about adults' learning?

Thorndike was one of the few psychologists in the beginning of the 20th century, who believed that the ability to learn did not decline until age 35, and only then at a rate of 1 percent per year. The ability to learn does not decline but the speed with which we learn does. Thorndike et al. *Adult Learning* published in 1928 and 1932, presented research on that particular topic.

Can an older adult learn like a younger person? Does she/he have the same prerequisites or conditions for learning? And what about aging and learning? We know more today about what causes adult learning and what kinds of difficulties individuals face when they get older. Adult educationists were the first to start describing different forms of learning and education: formal, non-formal and informal, as well as different conditions that such settings imply. They also included the importance of experience, practice and previous levels of education for learning as an adult; treating learning as a process and making a difference between how we learn and what we have learnt (Jarvis 2001). In this process we take into account both time and breadth of learning, calling it lifelong and life wide learning. "Learning is as crucial as breathing to the human being. It is the process whereby individuals develop their minds, sense of self and identity, biography and their own history. Learning is the very basis of our humanity – it is the process of internalising the external world and being able to locate ourselves within it" (Jarvis 2001, p. 201).

While many adult educationists emphasise learning as a social process, some psychologists and neuroscientists seem to regard it more as an individual accumulation of knowledge, facts and information, and often as a result or outcome of certain efforts or actions. Thus, cognitive abilities and memory can be crucial for understanding how we learn. Memory is seen as how much we have remembered or forgotten. However, Nilsson and Larsson (2007) undertook research on both short-term memory (working memory) and long-term memory among adults. The novelty of this research is to examine four types of long-term memory: 1. procedural memory (skill memory) which develops when we are small and is needed to complete skills; 2. perceptual memory which we use to identify objects and others; 3. semantic or meaningful memory which is needed to gather and store facts about the world, to find coherence between different facts and to process relationships between concepts and symbols; and 4. episode memory or event memory which makes us remember among other things what we did last week. The last two develop when we are more mature. According to Siegel (1999, p. 34), however, memory is crucial for autobiographical consciousness. In this sense, Siegel's contention might be closer to some biographical research understandings of the self (see, Horsdal 2011; Bron & Thunborg 2016, 2017). Siegel distinguishes two

types of memory: "explicit" and "implicit". The former has two forms, that is semantic or factual memory and episodic or autobiographical memory (oneself in an episode of time). Siegel also reveals humans' ability to carry out so called "mental time travel" (see Wheeler et al. 1997), necessary for "a sense of recollection of the self at a particular time in the past, awareness of the self in the lived present, and projections of the self into imagined future" (Siegel 1999, p. 35). However, our capacity to memorise things weakens as we get older, although long-term memory is not as affected as short-term memory. Therefore, most older adults have problems with remembering. Good quality sleep, however, may help us to remember better (Walker 2017). I will return to this point.

Theories of learning in adult education

Much research has been done on learning including both younger and older adults. What is more, several learning theories concerning adults were developed by studying adults' biographies. I will mention just four of them, starting with Mezirow's transformative learning theory and Alheit's theory of biographicity. Subsequently, I will include Bron's theory of floating, as well as Bron's and Thunborg's theory of biographical work.

Mezirow et al. (1990) discovered, while researching non-traditional college female students, two types of learning: communicative and instrumental learning. Through the processes of critical thinking and reflection, as well as self-reflection, both types of learning lead to the third, namely transformative learning. Instrumental learning is about learning how to do things. We control and manipulate nature and the social environment to achieve certain ends in the form of objects or processes/practice/systems. They can be very simple or very complicated, e.g. learning how to ride a bicycle and how to build complicated instruments. Communicative learning, on the other hand, means learning to understand. We want to understand the meaning of what others share with or convey to us, to find out what kind of message they communicate. Here we use different forms of expression like language, art, music and non-vocal gestures.

Mezirow (2003) does not make any value judgement concerning these two types of learning: he only states that both are typical for our learning. There is, however, a third type of learning which occurs on the basis of the first or second, when we begin to think about the process of what was happening when we were learning and what role we played in this event. This leads us to experience change and/or to transform our taken-for-granted perspectives. To be able to be engaged in such an action we need to be involved in two other processes i.e. critical reflection and self-critical reflection. The first comprises an assessment of the prerequisites of our own frame of reference and an examination of its sources as well as of the consequences that are necessary to bring about a change to our perception of reality. It cannot be perceived, however, as

an integral part of the immediate action process. A gap (a hiatus) is required so that we can rethink our own point of view and transform it ourselves, if necessary. The second process occurs when we assess the methods and our own frame of reference that we used to determine problems. Such a framework Mezirow calls 'habits of mind', that is a perspective, an opinion or a position which includes a structure of assumption that establishes a frame of reference for the interpretation of the importance of our experience.

However, how do we deal with a gap which arises in our perspective, and how do we change our 'habits of mind'? According to Mezirow, we use reflection and self-reflection in these processes. Are these the only actions possible? What more do we do to bridge the gap or change our perspective? Can sleep at various stages help us in this process, and if so, how?

The second theory of biographical learning, developed by Alheit (1995, 2018), is about biographicity. While dealing with biographies, Alheit considers that it is necessary to understand life's constructions. Biographicity is used generally to describe how adults construct and reconstruct their lives. This theory's function is to explain biographical action as an interaction with specific environments, while at the same time viewing it as a product of the biographical action in these environments.

We are able to constantly recreate and shape our lives in the context that we are in or belong to. Biographicity challenges the dualism between structure and actor and ties them together. This entity of structure and subject, Alheit based on Bourdieu's conception (Bourdieu 1986, 1990). By emphasising learning, the structural framework of biographical learning which affects our lives on the one hand, and our own actions on the other, can be merged into one entity. The value of this theory is in its epistemology, when Alheit perceives construction and reconstruction of knowledge as possible only as a biographical act. In this way knowledge is always connected to our biographies and embodied in ourselves. Knowledge is evidently transitional. There is no other knowledge but biographical knowledge, according to this theory.

However, how do we construct and reconstruct knowledge, when these processes are taking place? Obviously, our brain is involved when we solve problems and make use of our experiences. Do these processes only arise consciously? How do we deal with transitional knowledge biographically? Can REM sleep help us to solve them?

Biographical learning is characterized by our experiences, knowledge, and in a broad sense by lessons learned which appear in our life stories when we tell or write them down. The stories are told in the present; thus they are temporal, and are changed when told again after sometime due to changes in life which impact the stories and make them different. In biographical learning, in the stories told, we can discover the condition of floating (Bron 2000; Bron & West 2000). Floating defines a situation

where actors have a feeling of being disconnected from their biography, being stuck, not being emotionally able to plan for the future or understand the past. Floating means a condition that may last for several years. We can imagine a situation when an adult student experiences a cognitive unrest or dissonance. If something is not right in our life, on a cognitive, personal or emotional level, the activity (learning) stops and we may experience ourselves in a vacuum. We have difficulty in making any decision to move forward. The identity of the person (self) and its place, is perceived as fragmented and unrelated. New messages and perspectives are not experienced as valid and attractive enough to influence our own way of thinking and acting. The old ways of living are no longer enough, thus they cannot be used as a working frame of reference for managing our lives.

Once again, how do we cope with floating biographically? It is an emotional condition; thus it is not only cognitive but also occurs in our brain and body. Are only conscious processes involved? What happens during our sleep? Do we work out our state of floating during REM sleep? What happens when sleep, regardless of its stage, is distracted and/or disturbed?

While analysing biographical longitudinal data by using two sensitizing concepts, habitus and transitional space and the core category which emerged from the data, i.e. struggles, Bron and Thunborg (2015, 2016, 2017) and Bron et al. (2014) determined activities leading to identity formation. Thus, biographical learning became fundamental in their way of understanding formation and transformation of non-traditional students' identities. However, two different processes were important to understand what is happening with identities, i.e. anchoring (Fenwick 2006), and floating (Bron 2000). While the theory of floating helped to understand identity formation, both processes were necessary in recognizing transformations of identities. From these two processes, it was possible to theorise biographical work. In this sense, biographical work signifies repeatedly constructing and reconstructing our biographies when we are telling and retelling our story to others and ourselves. Such telling and retelling often include discoveries that interviewees were not aware of at first and are surprised by, which they need to work out, by being involved in reflection and self-reflection, thus learning (see Bron & Thunborg 2016, 2017).

Still, is it possible to generate such discoveries also from sleep, when we are subconsciously involved with work on floating and anchoring, finding solutions to unsolved problems and crisis? Perhaps neuroscientists can help us, adult educationists, in this matter.

All these theories, Mezirow's, Alheit's, Bron's, and Bron & Thunborg's are processual, looking at human biography in space and time, testified in the present or in the making, thus, perceiving learning as a process of an individual engagement through

socially situated life. However, they tell us about the results of such process as well, just in the moment of telling, i.e. how do we appreciate our lives, how do we see and understand ourselves, our decisions and our plans? Perhaps there is more to uncover, perhaps we actually can work out biographically different life dilemmas in our dreams. But this is an empirical question.

Possibly, when engaging in biographical research, we could ask adults what happens during their sleep when they are in a dreaming phase. It might be a difficult task, but worth trying. We can assume that neurobiologists/neuroscientists could ask the same question in their clinical studies. In this sense we could uncover some hidden areas of people's consolidating experiences in their memory and their reflections on the use of them when taking care of everyday life tasks and/or responsibilities, as well as dealing biographically with the self and others.

According to Siegel (1999, p. 52), "dream stages of sleep are thought to play a central role in recognizing memory and in reinforcing the connections between memory and emotions" as "nightmares, occurring during the dream stage of sleep and involving active REM sleep disturbances, may reveal futile attempts of the brain to resolve and consolidate such blocked memory configurations".

Biographical theories of learning have as a point of departure; a social adult, assuming that we are from the beginning social beings, as our encounters from the start are with significant others and we only gradually or eventually become individuals. The same view adult educationists might share with neurobiologists, e.g. with Siegel (1999, p. x) for whom "Interpersonal experience shapes the mind as it continues to develop throughout the lifespan".

Learning to sleep to be able to learn; possible connections

How does sleep influence our ability to learn? What use can we make of neuroscience research? How can this research inform us as adult educationists? Sleep clearly has an impact on our memory and learning abilities. Walker (2018, pp. 108-109) writes, "Sleep has proven itself time and again as a memory aid: both before learning, to prepare your brain for initially making new memories and after learning, to cement these memories and prevent forgetting".

One discovery demonstrated by Walker is "… sleep before learning refreshes our ability to make initially new memories. It does so each and every night" (Walker 2017, p. 109). This we can know from experience, but most of all from experiments which Walker (2018) and his team did. We know that while awake our brain is constantly obtaining and capturing new information. However, there is a problem with the capacity of the brain to take in all information and even more information. So how does the

brain handle such a situation? Walker's team started testing the theory of a file-transfer mechanism by using daytime naps to see if sleep moved newly gained memories to a more permanent, long-term storage. The advantage for those who slept was obvious, while the question tested was if learning capacity declines when a person is continually awoken during the daytime, and whether sleep can hinder this drop-in replenishment effect and can indeed restore learning ability. In this experiment researchers discovered that: "the memory refreshment was related to lighter, stage 2 NREM sleep, and specifically the short, powerful bursts of electrical activity called sleep spindles" … "The more sleep spindles an individual obtained during the nap, the greater the restoration of their learning when they woke up". "It was specifically the *change* in learning from before relative to after sleep, which is to say *replenishment* of learning ability, that spindles predicted" (Walker 2017, p. 110).

Thus, the brain deals with the memory capacity challenge by a file-transfer mechanism, which was a result of this experiment. Moreover, researchers repeated this study throughout a whole nights' sleep and came to the same results: "The more sleep spindles an individual has at night, the greater the restoration of overnight ability come the next morning". Hence, "the learning of new facts could begin again, anew, the following day" (Walker 2017, p. 111). However, it was also discovered that 60-80-year-old seniors are unable to generate sleep spindles. This led to a prediction: "the fewer sleep spindles an older adult has a particular night, the harder it should be for them to cram new facts into their hippocampus the next day, since they have not received as much overnight refreshment of short-term memory capacity" (Walker 2017, p. 111). Thus, over again sleep quantity and quality are necessary for older adults to keep their health intact and to be able to keep learning.

Neuroscientists have investigated the possible role of sleep in memory consolidation over a long time, but as Sara (2017) discussed, the sequential hypothesis has been very much ignored. However, we still do not know how it happens that some 'information' is forgotten, while the rest is, at it were, kept in storage. According to Poe "More waking practice cannot integrate new memories into old schema or erase irrelevant information during new learning", thus the question remains: "how does the brain work to tag a new memory for retention while leaving others to be erased during sleep?" (in Sara 2017, p. 461). It has, of course, a crucial consequence for adults by affecting their learning, especially as they get older.

Our ability to solve problems is another phenomenon. So, what impact does sleep have on solving problems? Walker (2018) indicates that the sleeping brain has the capacity to mix together unrelated sets of knowledge that advance remarkable problem-solving abilities. One can be surprised by how unusual memory blending is produced during the dreaming state – REM sleep. "We can awake the next morning with new

solutions to previously intractable problems or even be infused with radically new and original ideas" (Walker 2017, p. 76). In other words, we confront unsolved life crises and problems during our REM sleep, thus we perhaps learn biographically, and the result of this learning can be solutions to these struggles. Sleep is also important for our emotional life, especially the REM sleep, as well as for creativity. What is more, it helps us with cognitive intelligence by facilitating problem-solving abilities (see Deak & Stickgold 2010; Siegel 1999).

Whilst it seems obvious that sleep and learning are linked, it is "yet one more reason for medicine to take more seriously the sleep complaints of [the older adults], further compelling researchers … to find new non-pharmacological methods for improving sleep in aging populations worldwide…" according to Walker (2018, p. 111). Perhaps learning to sleep, sleep hygiene, could be a new task for adults. We know now how important sleep might be for our biographical learning. How can we then facilitate adults to enjoy a good night's sleep? Leitz (2007), Loiselle (et al. 2005) and Walker (2018) provide some advice for a good sleep hygiene practice.

However, another question remains, how do adult educationists deal with neurobiology and learning, and not least, or above all, with biographical learning? An interesting way of learning from each other is, for example, Siegel's statement on autobiography and narrative, when he writes about experiences' integration in the brain and how we can know that such integration has occurred. "An important means of assessing integration is the coherence of the structure of autobiographical narratives. Narrative coherence is reflected both in the way a life story is told, as well as the way life activities are lived. These linguistic and behavioural outputs are generated from a proposed central integrative process. Developing the capacity of integrated mental coherence is profoundly influenced by experiences. In this way, attachment histories revealed in adult attachment narratives reflect the capacity of the individual to integrate a coherent sense of self" (Siegel 1999, pp. 8-9).

Another example of using neurobiology, this time in adult education biographical research, is to be found in Horsdal's (2011) work on narratives. In her research she combines thoughts of the neurobiologist, especially on memory, emotions and social brain with humanistic ideas of Bakhtin (1981) and Ricoeur (1984), as well as of linguistics (Lakoff 1980 and Labov 1966), and anthropology (Bateson 1973), to name perhaps the most obvious relevant theorists in this space.

Getting back to adult education as a discipline, biographical researchers might agree with Siegel (1999, p. 9) when he writes, "By organizing the self across past, present, and future, the integrating mind creates a sense of coherence and continuity". In this way, neurobiological and social science perhaps can come to the same conclusions.

Conclusions

In conclusion, sleep is arguably good for learning at any age, from infancy to older age. Neuroscience research suggests that the quality and quantity of sleep are crucial for memory learning. However, what learning is for neuroscientists is not necessarily the same as for adult educationists. While the former look at learning mostly as cumulative knowledge and information, training memory and being involved in solving problems (cognitive psychology), adult educationists particularly perceive learning as a process of gaining experience, coping with identity changes and one's own biography. Together the two approaches can bring us closer to understanding how people learn which could be crucial to put biographical learning into another broader perspective. Some such approaches concerning neurobiology and narratives have already been attempted (Siegel 1999), as well as regarding narrative learning and the social mind (Horsdal 2011).

From this perspective we might conclude, "Learning is the very basis of our humanity" (Jarvis 2001; Perski 2016), and that the "…shorter your sleep, the shorter your life span" (Walker 2017, p. 4). While we try to know more and understand human learning better, sleep has "… remained one of the last great biological mysteries" (Walker 2017, p. 5). Insufficient sleep causes poor learning, which is true for any age. But in older age lack of sleep causes memory decline, especially working memory. Adults generally need to sleep longer and better, not only to improve their health but also their learning ability, to obtain new information and knowledge and make their shorter memory work. What is even more important, sleep might contribute to solve problems that older adults struggle with during the daytime; it might add to their biographical learning. Thus, we can perhaps better understand how the dilemmas and problems we face, and struggle with during the daytime, are arranged and solved during our sleep. Here unconscious processes can suddenly be interesting for biographical researchers; how can we unpack them? How can we ask adults about them in biographical interviews? These are challenging and sensitive tasks. To quote Aleksander Perski, "I wonder if sleep is not just sufficient but necessary to learn something". (Personal communication 2019).

The hypothesis in this article is that sleep habits and biographical learning can be connected by influencing each other. The review of previous research shows that such a connection may be possible but not have been empirically tested. Sleep habits can be improved and influence adults' ways of learning (cf. Loiselle et al. 2005; Walker 2017, p. 292 and pp. 341-342). I believe we need to learn how to sleep better in order to improve the quality of our learning.

Bringing sleep to biographical learning seems sound and natural. For adult educationists the challenge is how to incorporate biographical dreams, which occur while we sleep, into daytime life stories to enable adults to make biographical sense of their life

struggles, crises and experiences. However, neuroscientists and especially neurobiologists might add to an understanding of how we create biographies during daytime and sleep, and by that, perhaps even to a better understanding of our biographical learning.

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SLEEP HABITS AND BIOGRAPHICAL LEARNING. A REVIEW OF PREVIOUS RESEARCH ON THEIR CONNECTIONS

SUMMARY: This article examines adult learning and sleep habits. It is commonly assumed that learning occurs during the daytime. However, how does a good night's sleep or shortage of sleep contribute to our learning? Do we learn during sleep? This paper seeks to critically examine previous research into two myths concerning adults: adults cannot learn when they get older, and the second older adults need less sleep. But what can research say about this? What do we know about sleep in the first place? What do we know about adult learning and especially biographical learning? How do sleep patterns/habits influence adult learning? The author discusses these questions below as well as the consequences of a good quality and quantity of sleep for adults' memory and biographical learning. The author also seeks to identify some guidelines and advice from previous research into better sleep to enhance learning in older age.
KEYWORDS: biographical learning, adult learning theories, memory, experiences and sleep, REM sleep and learning, older adults and sleep habits, neuroscience and adult education.

SEN A BIOGRAFICZNE UCZENIE SIĘ – ICH ZWIĄZKI W ŚWIETLE ZASTANYCH BADAŃ

STRESZCZENIE: Opierając się na badaniach w neurobiologii i teoriach biograficznego uczenia się, artykuł rozpatruje możliwy związek między uczeniem się dorosłych a nawykami dotyczącymi snu. Powszechnie przyjmuje się, że uczenie się ma miejsce w ciągu dnia. Jak dobry sen lub brak snu przyczynia się do naszego uczenia się? Czy uczymy się podczas snu? Niniejszy artykuł ma na celu krytyczne przeanalizowanie wcześniejszych badań nad dwoma mitami dotyczącymi dorosłych: że dorośli nie mogą się uczyć, gdy się starzeją, a drugi, że starsi ludzie potrzebują mniej snu. Ale co mogą na ten temat powiedzieć badania? Co wiemy na temat snu? Co wiemy o uczeniu się dorosłych, a zwłaszcza

uczeniu się biograficznym? Jak nawyki senne wpływają na uczenie się dorosłych? Autorka omawia te pytania, jak również konsekwencje dobrej jakości i ilości snu dla pamięci dorosłych oraz uczenia się biograficznego. Stara się również zwrócić uwagę na porady wynikające z poprzednich badań dotyczące jakości snu w celu poprawy warunków uczenia się w starszym wieku.
SŁOWA KLUCZOWE: uczenie się biograficzne, teorie uczenia się dorosłych, pamięć, doświadczenia i sen, sen REM i uczenie się, osoby starsze i nawyki snu, neuronauka i edukacja dorosłych.