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Pesantren Revitalization as an Effort to Prevent *Brain Rot* in the Young Generation: A Neurological Approach

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Abstract

The digital era that triggers excessive social media consumption has given rise to a non-medical term called "brain rot" as named by Oxford as Word of the Year 2024. Of the various writings on the brain rot phenomenon, there are still very few that offer steps to anticipate this phenomenon from occurring in the young generation of Indonesia. This study aims to offer a perspective on "revitalizing Islamic boarding schools" as an effort to overcome this problem. The method used is the "qualitative grounded theory" method. This study utilizes a neurological approach to explain the relationship between the brain rot phenomenon and the revitalization of Islamic boarding schools. The research data were obtained through literature studies, which were taken from data sources in the form of writings or statements by experts regarding Islamic boarding schools, Islamic boarding school revitalization, neurology, and brain rot. The data that was successfully collected was then analyzed with the following stages: data reduction, data presentation, verification with a neurological approach.

Keywords: Brain Rot; Pesantren; Neurology

A. INTRODUCTION

The discourse on the negative impact of social media on the mental state of adolescents has again attracted the attention of the masses with the emergence of news about "*Brain Rot*". On December 18, 2024, Tirto news media wrote, "*Dan belakangan, overkonsumsi media sosial memunculkan sebuah istilah bernama brain rot yang baru-baru ini dinobatkan oleh Oxford menjadi Word of the Year 2024*" (Cholandha, 2024) (And lately, social media overconsumption has given rise to a term called brain rot, which was recently named by Oxford as the Word of the Year 2024). Oxford itself released the information on its website on December 2, 2024: "*Following a public vote in which more than 37,000 people had their say, we're pleased to announce that the Oxford Word of the Year for 2024 is brain rot*" (Oxford, 2024). Although only unilaterally named by Oxford University Press, the *brain rot* phenomenon at least inspires pesantren managers, including parents, to conduct further investigations, especially regarding the factors behind its emergence, as well as the various implications that accompany it. The brain as the main human device in living life, here, juxtaposed with the word "rot", is certainly very heartbreaking, or at least offends the curiosity of people who listen to it, about what has actually happened. Understanding this phenomenon requires the study of the human brain: neurology. The results of neurological studies will be applicable in efforts to revitalize pesantren.

Children, santri, and the younger generation in general, are the main targets of this *brain rot* phenomenon. Pesantren, as educational institutions, play a vital role in 'saving' the younger generation from this 'disease'. However, there needs

to be a revitalization of pesantren that is relevant to this role. Revitalization means "*the process of reviving, restoring the spirit, energy, or function of something so that it can operate as before or even better and more relevant*." The utilization of neurological studies provides relevance for pesantren to become a bulwark against the symptoms of *brain rot*.

So far, there has been no study that discusses the relationship between the emergence of the *brain rot* phenomenon and the pesantren revitalization process. It is still unclear how to revitalize pesantren in the midst of this *brain rot* case. Or, in other words, there is still no practical clarity on how to handle the *brain rot* phenomenon. This study aims to provide information in the effort to revitalize pesantren, which is relevant to the *brain rot* phenomenon, using a neurological approach.

B. LITERATURE REVIEW

Pesantren Revitalization

Efforts to revitalize pesantren have been widely studied. However, there are still *research gaps* in previous studies related to the revitalization of pesantren, as shown in the *literature review* table below:

Studies on the revitalization of Islamic boarding schools in the digital and globalization era are the main focus of several studies described in the following seven journal articles. These studies generally respond to the existential and functional challenges faced by Islamic boarding schools in the era of the Fourth Industrial Revolution and the crisis in Islamic education in general. Ani Rindani, Ahmad Nurwadjah,

and Andewi Suhartini (2022) in their article in Al-Wasathiyah highlight the threats to the vitality of Islamic boarding schools in the 4.0 era. Through a library research approach, they conclude that Islamic boarding schools still exist amid the tide of globalization, with certain indicators showing their institutional resilience. Mohammad Darwis (2020), in the journal Dakwatuna, emphasizes the importance of revitalizing the role of pesantren to ensure their survival and relevance. According to him, by strengthening this role, pesantren can produce graduates capable of competing in modern society.

Research by Ida Zahara and colleagues (2023) in Islamic Education expands the scope of revitalization by focusing on religious moderation education in Islamic boarding schools. Through contextual analysis, they found that moderation in Islamic boarding schools is built on two foundations: theological and sociological. Meanwhile, Suwarno (2017), through the journal Kuttab, highlights the declining public trust in the role of pesantren in producing a generation that is knowledgeable and has good character. He offers solutions in the form of curriculum reform, strengthening human resources, and developing learning management systems. Nisfiatur Ramdiyah (2020), in a case study of students at the Islamic University of Indonesia, examined the relationship between character education and the moral degradation of the millennial generation. She concluded that character building among students plays a significant role in responding to the moral crisis.

Finally, M. Miftahul Ulum (2012) discusses the crisis in Islamic education in the journal At-Ta'dib. He proposes revitalizing Islamic education through a re-examination of

its philosophical characteristics and repositioning the role of Islamic educational institutions in line with their vision and orientation. In general, all these studies emphasize that revitalizing Islamic boarding schools is not merely about preserving their existence but also strengthening their role as agents of social, moral, and spiritual transformation in facing the challenges of the modern era. Meanwhile, Hasbi Indra (2020), through the journal Fikrah, highlights the weak position of Islamic boarding schools in supporting national education development. He emphasizes the need to revitalize the curriculum of Salafiyah Islamic boarding schools as a response to changing times. From the above studies, it can be seen that there are so many research gaps that occur, such as: the *evidence gap*, which can be seen from the inconsistency of the results, the *knowledge gap* with the unrevealed vitality of pesantren in the vortex of the "*brain rot*" phenomenon, which also shows the *theory gap* due to the unavailability of theory to explain the role of pesantren in preventing *brain rot* in the younger generation.

Brain Rot

There has not been much investigation into the term "*brain rot*". There are at least three studies that have addressed this topic.

1. In their article titled "*Brain Rot: The Cognitive Decline Associated with Excessive Use of Technology*", Shailesh Mishra and Kiran Kumari Mishra describe what actually happens regarding this "*brain rot*" problem using 3 theoretical frameworks that can explain this:

a) Cognitive Overload

Cognitive overload occurs when the amount of information input exceeds one's processing capacity. Quoting Fotria (2019), that frequent distractions due to notifications and digital communication have a negative impact on productivity and mental acuity.

b) Neuroplasticity and Technology

Neuroplasticity refers to the brain's ability to reorganize itself by forming new neural connections. Although the brain can adapt to technology, constant reliance on search engines and social media can reduce memory and critical thinking skills, as cited by Nicholas Carr (2010), that the brain's default mode is being altered, with people increasingly prone to distraction and superficial engagement, rather than deep thought.

c) Social Interaction and Emotional Intelligence

Digital technology has changed the way humans interact socially, from face-to-face to online. Research from Twenge (2017) revealed a correlation between the use of digital devices and increased feelings of loneliness and anxiety, further exacerbating cognitive decline (Mishra and Mishra, 2024).

2. In another paper, by Zachari Siraj: "*The Impact of Information Presentation on Teenagers' Comprehension: A Battle to Degrade Brain Rot*", the discussion emphasizes the differences that result

from learning through manual media (technology) - in this case *paper-based texts* - and digital media (Siraj, 2024).

3. A study of the *brain rot* phenomenon, which is seen as a worldwide problem, a global public issue, which demands collective action, was conducted by Aylin Idikut Özpençe in her article: "*Brain Rot: Overconsumption Of Online Content (An Essay On The Publicness Of Social Media)*".

It can be seen that studies on *brain rot* still leave a "*Practical Knowledge Gap*", where knowledge about *brain rot* has not been known practically by pesantren managers and parents in general, in an effort to revitalize pesantren.

This paper is made in order to fill the gaps mentioned above, which also shows the originality of the research. The aim is, as the title of the paper suggests, to revitalize pesantren in the era of the emergence of the *brain rot* phenomenon. The approach or theory needed in this research is a neurological approach, which allows the brain rot phenomenon to affect the revitalization efforts of pesantren. By linking the pesantren revitalization process with the *brain rot* phenomenon, by utilizing neurological theories, this paper provides novelty, in the form of research results that contribute to the development of theory and practice. The research results also contribute to providing new knowledge, strategies, models, patterns, and methods related to the topic under study.

C. RESEARCH METHODS

To revitalize pesantren in relation to the *brain rot* phenomenon, the method used is the "*qualitative grounded theory*" method. This research utilizes a neurological approach to explain the relationship between the brain rot phenomenon and the revitalization efforts of pesantren. Research data were obtained through literature studies, which were taken from data sources in the form of writings or statements of experts regarding pesantren, pesantren revitalization, neurology, and *brain rot*. The data that was successfully collected was then analyzed with the following stages: data reduction, data presentation, verification with a neurological approach.

D. RESULTS

Pesantren Revitalization

To quote Zamakhsyari Dhofier, the vitality of pesantren lies in their strong development, which is reflected in the tremendous influence of Islamic parties in Indonesian political life from the 1910s to the 1950s. On the other hand, the number of students in pesantren far outnumbered those in Dutch schools. The vitality of pesantren began to weaken in 1949, when the Indonesian government carried out massive development of public schools, which was also related to the placement of administrative positions. The revitalization of pesantren in such a context, which made them survive, was carried out in the form of organizing public schools within the pesantren (Dhofier, 2019).

Efforts to revitalize pesantren in the current context, which is different from the context when Zamakhsyari's writing was published, have different forms. Currently, pesantren are not present in the midst of wars or independence struggles, but in the midst of the use of all-digital technology, globalization, transformation in all fields, and the like. Thus, an interdisciplinary study is needed in revitalizing pesantren. Various forms of pesantren revitalization have been offered. This paper, offers from the discipline of neurology.

Neurological Approach: Looking at How the Human Brain Works

The human thought process is undergoing a change, as reality is coming to us through computers and digital devices (Kilham, 2016). For today's children, the original digital generation, this new crazy world is their world, filled with excitement and possibilities. One thing is for sure: there is no going back. "*Technology is becoming an inexorable and unstoppable force, and one we don't want to be a part of*", writes Jim Taylor (2012). His visual, digital communication requires neurological studies to see its impact.

Visual communication, or "the *process of sending information (visual data) from the outside to a person through the eyes*", although it is received first through the eyes, the information is actually processed by the brain. More than half of the brain is used to process visual data, and involves about 30 different areas specialized for understanding such information, such as movement, color, and so on. Therefore, to understand how vision (perception) works, a neurological

approach is important as a theoretical basis for problem solving: explaining the inter-neuron interactions in a system. In neurological research, visual objects can be processed and form the basis for future actions without passing through consciousness at all. Children and adolescents reason primarily through emotions, as the *frontal lobes of* the brain develop, making them particularly susceptible to the influence of behavioral norms absorbed unconsciously through visuals, in the way they think and act. At the same time, the existence of the "*Mirror Neuron System*" provides another implication, that one imitates what one sees, both consciously and unconsciously (Barry, 2020).

Apart from the visual aspect, the problems that occur in the brain also occur in the memory aspect. Nicholas Carr explains this at length in his work, which has been translated into Indonesian: "*The Shallows: Internet Mendangkalkan Cara Berpikir Kita?*". According to him, the internet has replaced human personal memory. Quoting Clive Thompson, the internet appears as an "external brain" that takes over the role previously played by the internal brain (inner memory). The presence of the internet, as Peter Suderman notes, makes the use of the human brain no longer efficient, the memory in the brain, today, is only a 'simple index' that directs a person to a place in internet memory when he needs it (Barry, 2020).

The art of remembering, as reflected in the words of William James, is the art of thinking. Today, however, memory no longer has transcendental value, it is no longer even human. The functionality of the brain has been replaced by machines. As such, remembering is no longer as special as thinking. Memory in the human brain was divided into two

categories by William James (1890) as "primary brain" and "secondary brain". Primary memory, according to him, is where short-term memories are stored, while secondary memory stores memories in the long term. In this regard, Georg Müller and Alfons Plizecker in the late 1890s found that primary (short-term) memory can be consolidated into secondary (long-term) memory for approximately one hour. This consolidation phase can be interpreted as remembering something in a focused way for an hour or more, making it stick in long-term memory (Barry, 2020).

However, as Hermann Ebinghaus points out, the consolidation results must still be reinforced by a process of repetition. In this repetition process, the "concentration of neurotransmitters at the synapses" changes: the strength of the inter-neuron connections changes. On the other hand, the interconnected neurons give birth to entirely new "synapse terminals". In short, long-term memory formation involves not only "biochemical changes", but also "biological changes" (Barry, 2020). The author illustrates the explanation as follows:

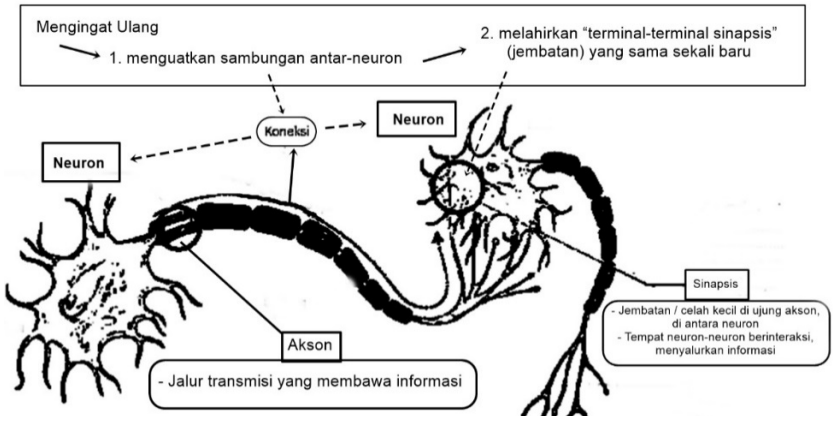


Figure 1: Authors' Engineering of Long-Term Memory Formation.

To quote Kobi Rosenblum, how different the human brain is from the 'artificial brain' on the internet. According to him, "the artificial brain is like a computer, absorbing information and immediately storing it into memory, while the human brain continues to process information long after it is received (for the first time), and the quality of memory depends on how the memory is processed". This means that human memory is alive, while artificial memory is not. The human brain is constantly updating past memories, rather than forming them. Biological memory, therefore, is constantly undergoing renewal (Barry, 2020).

An important point made from Nicholas Carr's article is the link between memory consolidation and "attention". Explicit memory (consciously acquired information or memories), to be used as short-term or long-term memory, depends on the attention given. Successful memory consolidation requires strong mental concentration, as a prelude to further efforts: repetition and intellectual and emotional engagement. Ultimately, strong or sharp memories are the result of strong and sharp attention. Psychologist Bruce McCandliss describes the brain's process from attention to the formation of long-term memories (Barry, 2020). The author describes Bruce's brain process as follows:

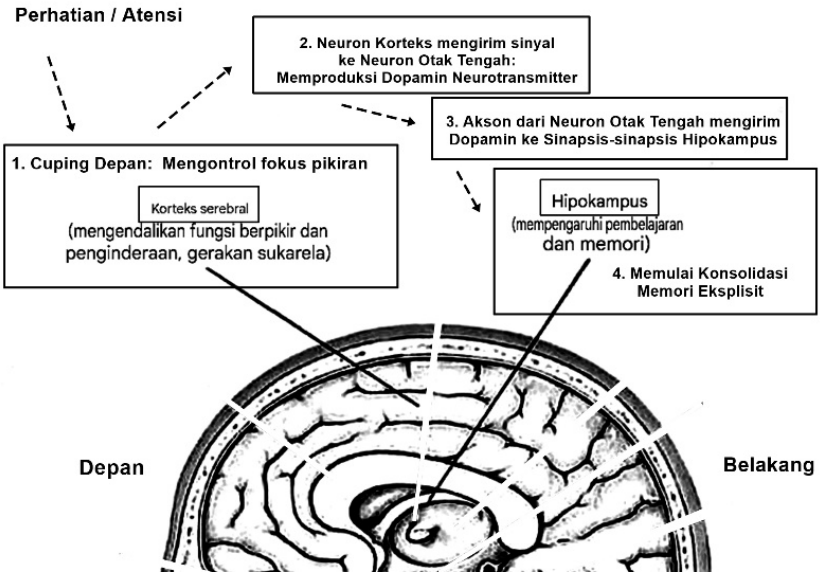


Figure 2: The Author's Engineering of the Brain's Work Process from Attention to the Formation of Long-Term Memories according to Bruce McCandliss.

In conjunction with the *online* internalization process, where such a heavy flow of messages enters the brain, the brain's frontal lobe will have difficulty focusing on one thing. Subsequently, the consolidation process is hindered. If this process keeps repeating, the brain gets used to processing information very quickly and efficiently, but without attention. In everyday life, such a brain will find it difficult to concentrate even when not in front of a computer. The habit of utilizing technology forces a person to rely more on the artificial memory provided by the internet, and makes it difficult to use their biological memory. Humans are given the freedom to choose, including choosing how one thinks. Quoting David Foster Wallace's statement, that the way one thinks is a form of control or determination of how and what one thinks, a

form of one's awareness of giving attention and his choice of how to build meaning from experience. In short, one gives up control of one's attention at one's own risk (Barry, 2020).

Neurology or what Muji and Rindiyani Pengestuti call "neuroscience" is also found in the Qur'an. Among the verses that allude to neuroscience, according to the two, is Q.S. Al-'Alaq: 15-16: كَلَّا لَئِنْ لَّمْ يَنْتَهِ ۙ لَنَسْفَعًۢا بِالنَّاصِيَةِ ۙ نَاصِيَةٍ كَاذِبَةٍ خَاطِئَةٍ ۚ, *Sekali-kali tidak! Sungguh, jika dia tidak berhenti (berbuat demikian), niscaya Kami tarik* ***ubun-ubunnya*** *(ke dalam neraka), (yaitu)* ***ubun-ubun*** *orang yang mendustakan (kebenaran) dan durhaka*. (*Never! Indeed, if he does not cease (from doing so), We shall surely draw* ***his head*** *(into Hell), (i.e.) the* ***head of the*** *one who denies (the truth) and disobeys*).

The word ''نَاصِيَة'' in the verse is often interpreted as "crown of the head", which in neuroscience is called the "*frontal lobe*" (forebrain) responsible for conscious motor control, emotional expression, and moral behavior. This frontal brain is, simply put, the center of consciousness that functions as problem solving, judgment, and responding to information. When it comes to education, neuroscience sees that one's learning success can be determined by the brain and neural networks: the more complex and strong the neural connections formed in the neurocortex, the higher the quality of one's intelligence. Quoting Taruna Ikrar's statement, that the things that a teacher needs to pay attention to about his success in understanding his students include knowing:

a. How the brain stem responds to the environment
b. How the amygdala responds to students' positive or negative emotions during learning

c. How the autocortex and prefontal cortex process knowledge information
d. How the hippocampus stores learned memories to form new knowledge synapses.

Thus, improving student learning success can be done by shaping learning conditions that allow the human brain to function optimally (Muji dan Pangestuti, 2022). An explanation of the learning process using a neuroscience approach will benefit in the form of knowledge related to how the human brain works. This is certainly very valuable considering that learning is very dependent on the state of the brain (Muji dan Pangestuti, 2022).

Brain Rot

"*Brain Rot*" is not a medical term, but a term coined by today's society to describe "*the mental state caused by excessive consumption of social media content*". In the Oxford University Press website, "*Brain Rot*" is defined as: *"The supposed deterioration of a person's mental or intellectual state, especially viewed as the result of overconsumption of material (now particularly online content) considered to be trivial or unchallenging. Also: something characterized as likely to lead to such deterioration"* (Muji dan Pangestuti, 2022), (deterioration of a person's mental or intellectual state, especially seen as the result of overconsumption of material -now especially online content considered to be trivial or unchallenging. Also: something characterized as likely to cause such deterioration). This brain rot reflects a

human concern with the technology that he himself created: "social media", as written in the next paragraph: *Our experts noticed that 'brain rot' gained new prominence this year as a term used to capture concerns about the impact of consuming excessive amounts of low-quality online content, especially on social media. The term increased in usage frequency by 230% between 2023 and 2024* (Muji dan Pangestuti, 2022).

Broadly speaking, the term brain rot refers to low-quality or low-value content found on social media and the internet. Casper Grathwohl, President of Oxford Languages, said: "*Brain rot speaks to one of the perceived dangers of virtual life, and how we are using our free time. It feels like a rightful next chapter in the cultural conversation about humanity and technology*" (Muji dan Pangestuti, 2022).

Nur Maghfirah Aesthetika M.Med.Kom, a social media expert at Muhammadiyah University of Sidoarjo (Umsida) said that the generation most entangled in this *brain rot* phenomenon is gen Z. According to her: "*Kalau generasi milenial masih cenderung minim sekali menggunakan teknologi, saat itu media sosial juga belum ada. Hal ini berbeda dengan gen Z yang sejak lahir sudah dimanjakan dengan kehadiran teknologi.*" (The millennial generation still tends to use very little technology, at that time social media did not exist. This is different from gen Z, which has been spoiled by the presence of technology since birth). Pampered means that technological advances provide a lot of convenience and comfort. "*Kegiatan yang paling menyenangkan menurut mereka adalah bermain gadget, scrolling, menonton konten receh, itulah hiburan mereka. Kalau generasi sebelumnya, jika tidak ada hiburan, ya kita berinteraksi dengan lingkungan*

nyata dan bersosialisasi," she added. What needs to be underlined is that this ease and convenience has an impact on real-life behavior, as Nur said: "*Jenis konten berdurasi pendek dan bisa dilewati bila ia tidak suka konten tersebut, maka hal itu bisa terbawa ke kehidupan nyata. Ketika mereka tidak menyukai sesuatu, maka mereka cenderung akan menghindari hal itu daripada menyelesaikannya*" (Romadhona, 2024) (The type of content is short and can be skipped if they don't like the content, then it can carry over to real life. When they don't like something, they tend to avoid it rather than solve it).

From her interview with CNN Indonesia TV, psychologist Afifah Fatin said, "*Untuk sosial media itu sendiri sangat berdampak (menyebabkan Brain Rot), karena aktivitas pada sosial media seperti TikTok, Instagram, atau YouTube Shorts itu kan aktivitas yang singkat, maksimal 30 detik sampai 60 detik dan itu sifatnya entertaining. Orang itu akan mendapatkan kepuasan secara instan. Dari kepuasan instan itu dan juga kalau kontennya dirasa tidak menyenangkan atau membosankan, bisa scroll lagi*. *Itu jadinya rentang atensinya berkurang*," (CNN, 2024) (For social media itself, it is very impactful (causing Brain Rot), because activities on social media such as TikTok, Instagram, or YouTube Shorts are short activities, a maximum of 30 seconds to 60 seconds and are entertaining. People will get instant gratification. From that instant gratification and also if the content is not fun or boring, they can scroll again. That's why the attention span is reduced.).

Considering the definition of *brain rot* as "*the deterioration of a person's mental or intellectual (cognitive) state that is primarily caused by excessive consumption of*

online content that is perceived as *trivial, unchallenging, and of low quality*", Shailesh Mishra and Kiran Kumari Mishra (2024), identified several points that indicate signs of brain rot (CNN, 2024):

1. *Memory Lapses*

Difficulty remembering recent events or new information, such as forgetting where someone put an item, or not remembering the details of a recent conversation, is caused by over-reliance on digital devices for memory tasks, such as calendars and reminder apps. These symptoms indicate a lack of engagement in cognitive activities that are important for strengthening memory.

2. *Mental Fogginess*

This symptom refers to a state of confusion and lack of clarity in the thought process. A person seems to be "at their wit's end" or mentally drained without understanding why. The causes include: cognitive overload due to constant notifications, *multitasking* across multiple screens, and information bombardment through social media and news feeds.

3. *Difficulty Concentrating*

The ability to concentrate on productive tasks and the completion of daily responsibilities, leading to decreased productivity and a greater tendency to make

mistakes, can ultimately perpetuate feelings of frustration and helplessness.

4. *Mood Changes*

Mood swings, including increased irritability and anxiety, often accompany cognitive impairment, particularly brain rot. Cognitive decline, which exacerbates emotional instability, can further lead to more serious mental health issues, such as depression.

5. *Language Difficulties*

When cognitive resources are overwhelmed due to overuse of technology, language processing may falter, there may be difficulties with word retrieval during conversations or difficulty understanding complex sentences, thus impacting social interactions and communication, both in familial and professional contexts.

6. *Decreased Attention Span*

One of the most significant symptoms of the brain is the ever-shrinking attention span, caused by instant gratification obtained through digital platforms. Studies by *Infotainment* show that the average attention span has decreased from 12 seconds in 2000 to about 8 seconds in a recent evaluation.

7. *Impaired Memory*

Increasing digital dependency has been shown to impair human memory. The "*Google Effect*", a term coined by Sparrow et al. (2011), indicates that individuals are less likely to remember information when they know it can be easily accessed online. This dependency weakens our ability to recall facts, reducing critical analytical and retention skills.

8. *Mental Fatigue and Anxiety*

Mental fatigue, which often results from increased screen time, can manifest as headaches, irritability and anxiety. A study by Hallowell (2010) explains how constant digital interaction can cause stress, making it difficult for individuals to disconnect and recharge.

In relation to education, digital education technologies that came later certainly bring differences with the technologies that came earlier (manual). By understanding the differences, one can analyze the various impacts that come with them. Zachari Siraj wrote in his work: "*The Impact of Information Presentation on Teenagers' Comprehension: A Battle to Degrade Brain Rot*", the differences that result from learning through manual media (technology) - in this case *paper-based texts* and digital media (Siraj, 2024):

Aspects	Manual	Digital
Annotations (notes in the form of information or comments on the text read)	Fosters concentration through tactile engagement	Relies on inter-activity and multimedia for concentration
	Requires deeper mental participation, which enables deeper processing and improves retention.	Convenient and easy to organize, as typed or marked notes are faster, but may lack intense brain engagement
Accessibility	The tactile quality of paper offers new sensory engagement in turning pages, highlighting, and annotating by hand	Encourages superficial participation, as teens may only skim through instant information
	Builds physical interactions that reinforce memory and understanding	Leads to disengagement and weaker recall for certain students
Environment	Offers a distraction-free atmosphere, which is important for teens who are developing attention resources	Easily distracted by notifications, *hyperlinks*, and the temptation to multitask, all of which increase cognitive load and break concentration

	Avoiding risks associated with prolonged screen time, such as eye strain and attention deficit	Associated with ADHD symptoms and fragmented focus, leading to potential developmental problems for adolescents
Health	Encourages the development of important cognitive aptitudes such as concentration, memory, and analytical skills that are critical for academic success and lifelong learning.	Allowing teens to explore new topics with ease and bringing a vast library in one device, however risks encouraging an over-reliance on quick retrieval of information rather than careful and focused understanding.

From the table above, brain rot can arise in the digital learning process. The consumption of *online* content, even though it is in the context of learning (by reading science materials on the internet, for example), is still part of the brain rot process, albeit at a low level. By comparing manual learning and digital learning, it can be concluded that digital technology that brings convenience to humans actually weakens brain function, making the brain as if it is 'rotten'.

E. DISCUSSION

Pesantren as a place where young people (santri) stay for a certain amount of time, has different characteristics from other educational institutions. One of the characteristics of pesantren is a lifestyle that is different from the lifestyle in general. For example, in pesantren, the use of digital technologies is minimal, instead of being consistent with the use of manual (analog) technologies such as the use of manual books (kitab kuning). Regarding the characteristics of pesantren, Abdurrahman Wahid, popularly known as "Gus Dur", mentioned one of the characteristics of pesantren: "subculture", a term that when freely translated becomes "cultural branch". This means that pesantren is a small culture within a larger culture, such as "Javanese culture", "Indonesian culture", and so on. However, Gus Dur underlined that pesantren are not entirely subcultural units. Only certain criteria of pesantren can make pesantren a subculture unit. These criteria, according to him, are as follows:

1. The pattern of pesantren life deviates from the pattern of life in Indonesia in general
2. The existence of special (unique) supports for the sustainability of pesantren
3. The uniqueness of the process of value formation in pesantren, along with its symbols
4. The attractiveness of pesantren in terms of alternative life attitudes of the community
5. The reciprocal relationship between pesantren-society culminates in the formation of new values

that are universally accepted by both parties (Wahid, 2010).

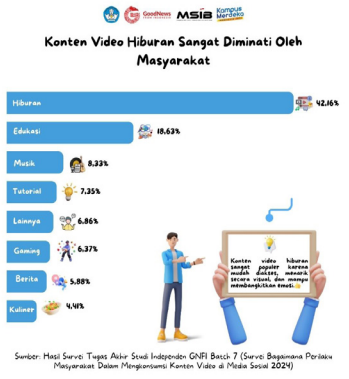
6. From a neurological approach, the distinctive cultural characteristics of pesantren, which are almost close to sub-culture status, become an overview of its relevance to the prevention of contemporary global diseases: *brain rot*. A more specific picture can be seen from the rules that apply in pesantren: santri are not allowed to bring cellphones (*Hand Phones*). As applicable in Pondok Pesantren Al-Furqan Ambal, where the author is a caretaker, or perhaps in other pesantren, there is a prohibition on students bringing cellphones. This culture should be able to reduce or even ward off the virus called "*brain rot*", because there is no access for santri to use cellphones, which automatically denies the consumption of social media content, especially those with low value, even in santri's spare time.

7. Another special feature is seen in the use of manual learning tools in pesantren. In obtaining information, especially Islamic religious information, santri are required to study the yellow books one by one under the guidance of the teacher (*ustāẓ*), rather than searching freely on the internet. Learning through manual media (technology) - in this case *paper (paper-based texts*) in pesantren, as Zachari Siraj found above, allows preventing children from experiencing *brain rot*, that digital technology that

brings convenience to humans actually weakens brain function, making the brain as if 'rotten'.

8. In Aylin Idikut Özpençe's view, social media, like radio and television broadcasts, is a "*public good*" that is "*non-rivalry*" and "non-excludability". For Aylin, social media as a public good can be consumed by everyone for free, as they wish. All they have to do is buy personal items such as computers, smartphones, tablets, and so on, which allow access to social media. It is this public nature that enables low-quality *online* consumption on social media, which in turn causes "*negative externalities*". Excessive *consumption* of social media, or what Aylin calls "*polluted* consumption", is what raises social issues including *brain rot* (Özpençe, 2024). On this basis, the presence of pesantren is expected to be able to make the younger generation not drift into internet (social media) overconsumption behavior which ultimately makes them polluted by brain rot.

Based on this context, the revitalization of pesantren can be done by "strengthening pesantren traditions" such as the prohibition of students bringing cellphones and paper-based learning (kitab kuning). However, the problem is when santri return home, return to a non-pesantren culture, which opens digital fences with the freedom to use cell phones. Concerns arise considering that survey results prove, among other things, that people like to spend their time watching video content on social media, and entertainment content is the favorite of Indonesians (Ulwany, 2024):



To overcome this problem, the most important step is to equip students with "Digital Literacy" skills.

The current era, which some call the "Digital Age", presents issues such as: *information overload*, *quicker change*, globalization, the potential for more participatory democracy, and so on. Students, who are already familiar with electronic content and the tools used to engage with it, need to be knowledgeable about how to control it. Therefore, digital literacy, technological skills, the science of information and communication technology (ICT), must be mastered (Farmer, 2016). In the author's view, mastery of what is called "Digital Literacy" is paramount.

For the first time, the term Digital Literacy was introduced by Paul Gilster, in his work "*Digital Literacy*" in 1997, by defining it as "*the ability to understand and use information in multiple forms from a wide range of sources when it is presented via computers*". The definition of digital literacy continues to evolve, The American Library Association in 2013 defined digital literacy as: "*the ability to use information and communication technologies to find, evaluate, create,*

and communicate information, requiring both cognitive and technical skills". Douglas A.J. Belshaw, complemented the definition by dividing digital literacy into 8 elements, in the sense that digital literacy includes 8 main meanings:

a. *Cultural*: understanding of various cultural contexts
b. *Cognitive*: the use of a set of cognitive technology tools
c. *Constructive*: creation with technology
d. *Communicative*: understanding how communication media works
e. *Confident*: understand problem solving
f. *Creative*: doing new things in new ways.
g. Critical: reflections on digital practices in various semiotic domains
h. *Civic*: the use of technology to support and develop social society, in other words: "*digital citizenship*" (Farmer, 2016).

With such digital literacy, students, when at home, can make the best use of technology and avoid exposure to low-quality content, which is the main cause of *brain rot*. The *critical* element provided in digital literacy allows children to learn something useful from the content they consume, or avoid content that is not important.

The adolescent brain is indeed a work in progress, especially in terms of its "*formal abstract-logic*" abilities and *values system*. They are very likely not to make logical assumptions, or think through their decisions and their logical consequences. Thus, they are less likely to set themselves

up realistically when conducting research, or to realize that they might commit plagiarism, for example. When such negative consequences occur, the "*teenager's neural circuits*" are *overloaded*, activating "*swinging emotional moods*" and worsening their situation further. At the same time, the brain is programmed to encourage *risk-taking* (*risk tasking*). Therefore, librarians should respond to this tendency by facilitating *intellectual risk tasking* (Farmer, 2016).

Young people tend to use computers for entertainment, such as social networking, e-games and videos. Some young people do not keep pace with their technological life and become addicted to the use of the internet, or *online* games for example, which eventually leads to *mood disorders* and *unhealthy living*. In conclusion, adolescents need procedural and conceptual knowledge about technology use: mechanical-technical operations, search techniques, comprehension and evaluation skills, data manipulation skills, and communication skills. Often, adolescents learn such skills by "*trial and error exploration*" rather than through formal training. As a result, many teenagers unrealistically think that they understand technology and are able to find their own way in the internet world. They may not understand what they are accessing: the author, the approach, the underlying message, etc. Librarians, again, may not understand what they are accessing. Librarians, again, must explicitly teach responsible use, which encourages teens' moral decision-making process (Farmer, 2016).

In conclusion, apart from strengthening pesantren traditions, the revitalization of pesantren in the midst of today's brain rot is to equip children (santri) with digital

literacy, which can be done, for example, by updating the pesantren curriculum.

F. CONCLUSION

The times have always brought changes to human life. In this second millennium era, changes are rapid and drastic, especially in relation to information and communication technology. Globalization, modernization, digitalization, the presence of the internet and social media, make people connected around the world, regardless of age, social status, religion, education level, or other dimensions of life. Pesantren, which have emerged before these changes occurred, are not exempted from being affected by these changes. The life or death of pesantren depends on the attitude and response of each pesantren institution.

At the same time, advances in science have kept pace with advances in technology. Although, in reality, negativity also accompanies it. A simple formula from Islamic teachings: *mā anzala Allāhu dā'an, illā anzala Allāhu shifā'an*, not Allah sends down a disease, but Allah (also) sends down a cure. The emergence of the phenomenon of "*brain rot*" may not be widely known, but, for the author, it can be said to be a "disease", especially for the younger generation. This article is meant to prevent or at least cure the disease.

The utilization of neurology, which is also not very familiar to the general public, as evidenced by the few studies of pesantren revitalization that utilize this science, will add to the scientific treasury for efforts to improve educational institutions, especially pesantren. Later, this paper is expected to be taken into consideration for the pesantren revitalization

process. In addition, for the general public, this paper can be a material for reflection in relation to the formation of children's personalities that require an educational process. If it is felt that the family environment is unable to provide optimal education to children, such as the inability of parents to minimize the use of cellphones by children, it can be considered to 'board' children in pesantren.

The weakness of this paper is its monodisciplinary nature, using only one approach: neurology. However, this paper can be used as material for further studies on the revitalization of pesantren, which involves many scientific disciplines: multi-disciplinary, inter-disciplinary and trans-disciplinary (MIT). This paper is only a response to the global problem of "brain rot", which is specifically related to the discipline of neurology. There are still many problems related to the development of the younger generation in this era that require MIT studies. So is the study of the vitality of pesantren.

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