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Changing beliefs in repressed memory and dissociative amnesia

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Abstract

In three studies, we examined whether beliefs in repressed memory and dissociative amnesia could be changed. Participants provided agreement ratings to statements related to repressed memory and dissociative amnesia. Then, they received a university course which included education on the science of memory. Following this, participants had to re-rate the statements. In Study 3, at Times 1 and 2, participants also received a case vignette on a therapy-induced recovered memory and rated several statements related to this case. Participants who received education on the science of memory were less likely to agree with statements endorsing repressed memory and dissociative amnesia—and participants were more likely to state that the case vignette involved a false memory. Providing education on the science of memory can help people (e.g., legal professionals, people from the general population) to use critical thinking on the topic of repressed memory and dissociative amnesia.

KEYWORDS
dissociative amnesia, memory wars, repressed memory, trauma

One area that has created much controversy in psychology is how traumatic experiences are remembered (McNally, 2005; 2021). This issue bears relevance to many situations such as how victims remember purported trauma. The controversy stems from the question of whether or not traumatic experiences can be unconsciously repressed. One of the main tenets of repressed memory, or the similar concept of dissociative amnesia, is that because of the overwhelming nature of trauma, people apply defense mechanisms (i.e., repression) in order to block out the trauma (Mangiulli et al., 2022; Otgaar et al., 2019). Repression theory posits that the traumatic memory is unconsciously buried, stored in a way that is not accessible for a period of time, and yet is able to be retrieved at a later time. Although much controversy exists concerning the existence of repressed memory, many people report a belief in the concept (e.g., Dodier, Patihis, et al., 2019; Houben et al., 2021; Patihis et al., 2014). In the current set of studies, we examined whether controversial beliefs in repressed memory and dissociative amnesia can be changed via university teaching in the direction of informed skepticism.

1 | THE DEBATE ON REPRESSED MEMORY

While some scholars have defended some aspect or variation of the repressed memory concept (Axmacher et al., 2010; Brewin, 2021; Brewin & Andrews, 2014; Erdelyi, 2006; for similar support for dissociative amnesia, see Brand et al., 2017), others, mostly memory researchers, have argued that traumatic experiences are well remembered and thus not unconsciously repressed (McNally, 2005; Otgaar et al., 2019). The debate on repressed memory gained momentum in the 1990s while several academics began to express doubts, and

some clinicians continued to claimed to see patients with unconsciously repressed memory. Some clinicians reasoned—along the lines of the Freudian tradition—that some patients' symptoms (e.g., sexual dysfunctions, anxiety, insomnia) were caused by hidden memories of trauma. For example, Van der Kolk and Fisler (1995, p. 512) argued that trauma can be "entirely organized on an implicit or perceptual level, without an accompanying narrative about what happened." To achieve clinical improvement, the argument went that the hidden memories of trauma should be recovered using therapeutic techniques. In contrast, some memory researchers argued that in attempting to exhume memories therapists could apply suggestive interview techniques that could lead to false memories (Loftus & Ketcham, 1994; Otgaar et al., 2022). In certain situations, these false memories resulted in false accusations and wrongful convictions, tearing families apart (Loftus, 1994; Otgaar et al., 2022).

Not only is there a concern that trying to unlock repressed memories could lead to false memories (Otgaar et al., 2019), there is also a concern that the empirical support for the existence of repressed memory is lacking. Some scholars have argued that claims of repressed memory could be explained by more plausible mechanisms. For example, victims oftentimes do not want to think or talk about trauma and that this is sometimes mislabeled as a repressed memory (e.g., McNally, 2005). Also, claims of repressed memory are oftentimes quite easily explained with ordinary forgetting mechanisms or failures to encode (part of) the events (Otgaar et al., 2019). Concerning recovered memories, research has shown that people incorrectly claim that prior to a memory recovery they never had previously remembered the event, while they actually had remembered it previously, a phenomenon called the forget-it-all-along effect (e.g., Janssen et al., 2022). Finally, there is evidence showing that sometimes individuals do not fully realize that an inappropriate event is abusive at the time (especially in childhood), and only later reinterpret it as emotionally disturbing—this is sometimes mislabeled as a repressed memory (McNally & Geraerts, 2009).

The debate over whether memories were falsely recovered in therapy has been called the memory wars (Crews, 1995). Although scholars had argued that the memory wars were over (e.g., McHugh, 2003), recent evidence shows that the controversy surrounding the topic of repressed memory continues to circulate in academic, clinical, and legal contexts (Brewin, 2021; Otgaar et al., 2019, 2021). For instance, research has shown that many populations ranging from students (Dodier et al., 2021) to professionals (e.g., clinical psychologists) strongly believe in the existence of repressed memory (Otgaar et al., 2019; Sumampouw et al., 2022).

Specifically, Otgaar et al. (2019) reviewed studies in which people were surveyed regarding their belief in repressed memory. They found that 58% ($n = 4745$) indicated to believe to some extent in the concept of repressed memory. Furthermore, 70% ($n = 2305$) of surveyed clinical psychologists indicated a belief in the existence of repressed memories. This endorsement of repressed memories was lower in the 1990s (61%; $n = 719$) and it increased to 76% ($n = 1586$) from 2010 onward showing that the belief in repressed memory may have become more pronounced. To put these percentages in broader perspective, Patihis et al. (2021) asked 17 memory experts a series of statements on the functioning of memory (e.g., "Traumatic memories are often repressed"). Memory experts were for the most part skeptical toward the concept of repressed memory and, on average, did not agree with the idea of repressed memory (mean agreement rating: 2.30 on a scale from 1 = strongly disagree and 6 = strongly agree; $SD = 1.40$). These discrepant views on repressed memory between memory experts and clinicians suggest that the memory wars debate continues today.

It is equally important to stress that in questionnaires that asked specifically about a belief in unconscious repressed memories, many people endorsed the idea (for a discussion on this see Otgaar et al., 2021). For example, in Otgaar et al. (2020), participants received the following statement "traumatic memories are often repressed." If people agreed with this statement, additional questions were posed that investigated whether they meant those traumatic memories are accessible during repression, and another question on whether they are unconscious during repression, or not. The results demonstrated that 89.5% ($n = 909$) agreed to some extent that traumatic memories can be repressed and, of those, 73.7% ($n = 670$) agreed that such memories are inaccessible, and 80.9% ($n = 735$) agreed that such memories are unconscious. Taken together, these results suggest that many people believe in the controversial concept of unconscious repression.

Relatedly, some scholars also seem to hold controversial beliefs on unconscious repression in academic writings (for an overview, see Otgaar et al., 2021). For example, Van der Hart and Nijenhuis (1995) described that memory loss due to trauma "involves a reversible memory impairment in which memories of personal experience cannot be retrieved in a verbal form, or, if temporarily retrieved, cannot be wholly retained in consciousness" (p. 1). To give another example, Kessler et al. (2017) wrote that "repressed mental contents are less accessible to conscious processing and still underlie dynamic processes. They might, for instance, generate associated material and intrude into awareness. In the case, that repressed material gains access to consciousness, it elicits a secondary repression excluding it once more from consciousness" (p. 1). These examples show that the concept of unconscious repression continues to be discussed within academic circles (see also Brand et al., 2018; Dodier, 2019; Merckelbach & Patihis, 2018; Patihis, Otgaar, et al., 2019). Although it is problematic that the belief in repressed memory is prevalent among many different populations, it is especially perilous among clinical psychologists. Clinical psychologists who endorse the notion of repressed memory may suggestively search for hidden traumas when treating their patients—which could lead to the formation of false memories.

Another worrisome issue in the resurgence of repressed memory is that the concept is sometimes disguised under a different name: Dissociative amnesia (Mangiulli et al., 2022; Radcliffe & Rix, 2019). Dissociative amnesia is defined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013, p. 298) as an "inability to recall autobiographical information" that (1) is "usually of a traumatic or stressful nature," (2) is "inconsistent with ordinary forgetting," (3) should be "successfully stored",

(4) involves a period of time when there is an "inability to recall," (5) is not caused by "a substance" or "neurological…condition," and (6) is "always potentially reversible because the memory has been successfully stored." The definition of dissociative amnesia fits seamlessly with the definition of repressed memory (see Otgaar et al., 2019 for a detailed comparison). For example, dissociative amnesia contains similar problematic components to repressed memory—central to which being the idea that autobiographical memories can be blocked due to traumatic experiences.

Furthermore, and in line with studies on beliefs on repressed memory (e.g., Dodier et al., 2021; Otgaar et al., 2019; Sumampouw et al., 2022), people tend to agree with controversial statements regarding both the cause and the underlying mechanism of dissociative amnesia. Specifically, Mangiulli et al. (2021) showed that more than 60% of their sample ($N = 1017$) agreed with dubious notions such as that being exposed to trauma during childhood would increase the likelihood of developing amnesia for those events. Hence, a critical eye should be given to the concept of dissociative amnesia, as well as repressed memory.

The problematic status of dissociative amnesia was exemplified in a recent study by Mangiulli et al. (2022) who reviewed 128 case studies on dissociative amnesia in the period 2000–2020. They found that none of the published case studies actually met the diagnostic criteria of dissociative amnesia as described in the DSM-5. The heterogenous nature of these case studies might be because dissociative amnesia lacks precise and objectively measurable signs and symptoms in the DSM-5. Mangiulli et al. (2022) found that more plausible alternative explanations for the claimed dissociative amnesia, such as ordinary forgetting or malingering, were frequently not considered in these case studies. Even more interesting, in some of the cases no traumatic precursor was even indicated or found prior to the purported dissociative amnesia.

Overall, there is a continued belief in the concept of repressed memory which might be damaging in the courtroom, thereby potentially contributing to wrongful convictions. As well as demonstrating that the debate on repressed memory lingers on, recently, scholars have become interested in investigating whether controversial beliefs in repressed memory can be corrected (Sauerland & Otgaar, 2022).

2 | CHANGING BELIEFS IN REPRESSED MEMORY

One way to view the concept of repressed memory is to regard its prevalence in society as being caused by some form of misinformation. Specifically, the type of publicly spread misinformation that contains information that is not supported by science (often called fake news: e.g., that vaccination is the major cause of autism). Because the idea underpinning repressed memory contains controversial elements that also are not supported by science (e.g., unconscious memories of trauma that can accurately be retrieved after many years), one way is to treat the idea of repressed memory as misinformation. Substantial inroads have been made in the area of correcting misinformation such as remedying fake news on the effectiveness of vaccines (e.g., Lewandowsky et al., 2012). One recurrent finding is that although misinformation can be corrected (see Greenspan & Loftus, 2021; Oeberst et al., 2021), it sometimes is not completely eliminated; a phenomenon also known as the continued influence effect (Ecker et al., 2022; Walter & Tukachinsky, 2020).

Several interventions have been devised that might potentially abolish or reduce the dire effects of misinformation (also called debiasing methods; Lilienfeld et al., 2009) such as providing preexposure warnings and repeatedly debunking the misinformation (Ecker et al., 2010; Ecker et al., 2011). Many of these interventions have been designed to switch cognitive processing from an automatic, heuristic style of thinking (e.g., System 1) to a more controlled style of thinking (e.g., System 2; Croskerry et al., 2013; Kahneman, 2003; Stanovich & West, 2000). The rationale behind this switching is that certain biases, like the belief in repressed memory, operate relatively automatically. In order to reduce those biases, people should become more aware of the intricacies of these biases. Such awareness might inform them about the erroneous nature of these biases.

Of interest for the current studies is research showing that education might affect people to shift to a more controlled mode of thinking. That is, research has revealed that education concerning specific biases can make people less vulnerable for certain cognitive errors such as the confirmation bias (e.g., van Stekelenburg et al., 2021). For example, Evans et al. (1994; Experiment 3) provided participants with elaborate instructions on principles in reasoning. Participants receiving such instructions were least likely to accept invalid conclusions based on syllogisms. Similarly, in the area of repressed memory, education could involve information regarding the science of memory. The idea of providing education to diminish the intensity of biases runs parallel to related effective debiasing methods such as providing alternative accounts and emphasizing the facts of a certain topic (Lewandowsky et al., 2012). Furthermore, this idea is linked to research showing that in order to correct misconceptions among students, scientific information should be provided that refutes these misconceptions (Guzzetti, 2000; e.g., lectures on the science of memory).

In a recent study, Sauerland and Otgaar (2022) provided students involved in a Legal or Forensic Psychology master program with an educational course on the science of memory. In this course, lectures and readings were included involving—among others—the fallibility of memory, eyewitness memory, and the effects of trauma on memory. At the start and end of the course, students were surveyed on their beliefs about different aspects of memory, including their beliefs in repressed memory. The most striking finding was that students became more skeptical toward the concept of repressed memory at the end of course compared with at the start. This belief change persisted after a long delay (6 or 18 months later).

Although promising, the study was limited in several aspects. For one, in Sauerland and Otgaar's (2022) study, there were only 2 statements related to repressed memory that were surveyed at the start and end of the course (i.e., "The mind is capable of unconsciously "blocking out" memories of traumatic events," "A poor memory for childhood events is indicative of a traumatic childhood"). Scholars

have criticized past survey work on repressed memory because oftentimes only a small set of belief statements was used to examine repressed memory (Brewin et al., 2020). This is problematic because repressed memory is a complex concept which is difficult to capture in merely one or two statements. Second, Sauerland and Otgaar's (2022) study primarily focused on changing beliefs in repressed memory. Dissociative amnesia encompasses similar problematic connotations as repressed memory and is especially popular in clinical settings and is in the DSM-5. It is presently unknown whether beliefs in dissociative amnesia can also be changed when basic education on the science of memory is provided. Hence it is of interest to examine whether beliefs in repressed memory and dissociative amnesia can be changed when knowledge is presented concerning the functioning of memory.

From a practical perspective, research on the effect of scientific education on beliefs about repressed memory and dissociative amnesia is vital as it might lead to important insights in how these two ideas can be debunked among many professionals. For example, both debunking and correction might be crucial to lower the chance that therapists might engage in suggestive treatment practices to uncover ostensibly hidden traumatic memories. If so, false accusations and wrongful convictions might be prevented. Furthermore, such corrections are not only relevant for professionals but can also be important for the general public. Raising awareness about the controversies surrounding the concept of repressed memory and dissociative amnesia can be beneficial for people from the general public who might know patients undergoing (suggestive) therapy, who themselves undergo treatment, or who might become jurors in legal cases involving repressed memory recovery. Developing a more critical attitude toward the concepts of repressed memory and dissociative amnesia might even make people more reluctant to go along with suggestions that they have hidden memories of trauma.

3 | THE PRESENT STUDIES

In the current studies, the goal was to investigate whether beliefs in repressed memory and dissociative amnesia could be corrected when educating participants on the science of memory. Specifically, we tested students' beliefs on repressed memory and dissociative amnesia at the start and end of a course which included education on the science of memory. Importantly, we used a wide variety of statements covering different aspects of repressed memory and dissociative amnesia. For example, while in previous research a focus was put on whether traumatic memories could be repressed, we also focused on other problematic aspects of repressed memory and dissociative amnesia. That is, we included statements such as whether unconscious memories of trauma can lead to depressive symptoms and whether people can develop multiple identities. Our chief prediction was that although students would display a strong belief in repressed memory and dissociative amnesia at the start of the course, this belief would statistically significantly drop at the end of it. Specifically, we predicted that belief ratings would be lower for statements on repressed memory and dissociative amnesia after participants received knowledge about the science of memory, compared to before.

4 | STUDY 1

4.1 | Method

4.1.1 | Participants

Participants were students from the Faculty of Law and Criminology, KU Leuven following a master course on Psychology, Law, and Criminal Justice[1]. The course was taught by IM (one of the co-authors). We attempted to reach a similar sample size or higher as in Sauerland and Otgaar (2022; i.e., N varying between 33 and 74) as that study showed successful belief reductions. Furthermore, in Sauerland and Otgaar's studies, a mean Cohen's d was found of 21.32[2]. An a priori power analysis for t-tests (matched pairs) showed that with a comparable effect size (Cohen's $d = 20$) and a power of .80 (two-tailed), a sample size of 2 is needed[3]. Nevertheless, this algorithmic suggestion was not deemed sufficient, so we aimed higher. Even though we initially registered 122 responses during the first session of the study, 20 students completed all parts of the study and were used in the final analyses (mean age = 21.60, $SD = .82$, range: 20–23; 18 female) showing that this study was adequately powered. Of importance, these 20 participants were those who rated all statements at both sessions (see below). The attrition rate may have been caused because of the coronavirus pandemic resulting in online learning, thereby preventing us from physically collecting data in class. The consequence is that advertising this study happened on digital learning spaces of students in which other teaching-related messages are posted as well. Hence, it was challenging to personally motivate students to partake in the current studies. Of the 122 registered responses, 92 completed the first survey. Their mean age (mean age = 22.07, $SD = 1.98$) did not statistically differ from the 20 students participating in both surveys ($t(110) = -1.03$, $p = .31$, Cohen's $d = .31$). This suggests that the students who dropped out likely did not differ on certain dimensions (e.g., age) from the students included in both surveys. Participants took part on a voluntary basis. The studies received ethical approval from the standing ethical committee. All data can be found on the Open Science Framework: https://osf.io/f6png/.

4.1.2 | Materials

Statements

In the current study, we used 35 statements on topics related to the field of psychology (i.e., memory and lie detection). Of these 35 statements, 23 statements were directly related to the topic of repressed memory and dissociative amnesia (see below) and only these 23 statements were used for our analyses. The statements were adopted from previous studies (e.g., Otgaar et al., 2021; Patihis et al., 2014; Sauerland & Otgaar, 2022; see https://osf.io/mg2kz). Statements referring

to various aspects related dissociative amnesia were newly created. Specifically, the first two authors (HO, IM) devised several statements related to dissociative amnesia and this list was then assessed by the last author (LP). After discussions and revisions among the three authors, a final list of statements was developed. Statements had to be rated on 7-points Likert scales (1 = completely disagree, 7 = completely agree).

Course on psychology and law

Participants were enrolled in a course (in English) on psychology and law that starts every semester at the end of September/beginning of October to the end of December 2020. Students received weekly lectures of 2 h on diverse topics related to psychology and law (e.g., expert witnesses, biases). Of importance for the current study were lectures specifically devoted to eyewitness memory, false memory, trauma, and memory. Specifically, related to trauma and memory, lectures were provided that discussed the general functioning of memory (e.g., reconstructive nature, forgetting curve), the formation of false memories, the memory wars, and the controversial elements behind repressed memory and dissociative amnesia. These themes were also taught in Studies 2 and 3. Because of the COVID-19 pandemic, some lectures were given online. Of note, in all studies, students did not receive any psychology-related courses at the Faculty of Law and Criminology which could have affected their belief ratings. In the Appendix A, we show the specific topics provided to the students.

4.1.3 | Design and procedure

Participants were involved in a within-subjects design. During the first lecture of the course, students were asked to participate in a study on memory (i.e., Time 1). A link to a Qualtrics survey was shared on a digital learning page of the course. If students clicked on the link, they were directed to the survey and asked for their informed consent. If they agreed to participate, they received several (demographic) questions (i.e., age, gender, ethnicity, level of education, and English proficiency). Also, to assure anonymity and link participants' responses, in all studies, participants were asked to generate a personal code by filling in their date of birth and the last two letters of their first name. Following this, they were presented with several statements and were asked to provide their level of agreement. Intermixed between the statements were two attention check questions[4] (i.e., "What is 2 + 2?," "Please respond 'black' to the following"). During the last lecture of the course, they were again asked to complete the online survey (i.e., Time 2), approximately after 11 weeks from the first lecture. The procedure was identical to the first one. When all statements were rated, they received an online debriefing.

5 | RESULTS AND DISCUSSION

We only included participants that rated all statements at Time 1 and 2. A total of 20 students were included in the final analyses. Paired-samples *t*-tests were conducted on the agreement ratings (two-tailed)[5]. The results can be found in Tables 1 and 2. As can be seen, except for the statement that dissociative amnesia can lead to new identities, all comparisons were statistically significant with Cohen's *d* effect sizes ranging between .43–1.59. When we applied a more stringent significance level because of the multiple comparisons (.05/23 = .002), 11 comparisons were statistically significant.

Taken together, data of Study 1 clearly demonstrated that students became more critical toward the concept of repressed memory and dissociative amnesia and their underlying mechanisms when they received education on the science of memory. Specifically, students were less likely to agree with statements on repressed memory and dissociative amnesia after they received extensive education on the science of memory. Our results are in line with previous research by Sauerland and Otgaar (2022), albeit with the exception that in the current study we included more statements on repressed memory and used—for the first time—a wide variety of statements on dissociative amnesia. Although the current findings are promising, Study 2 was conducted to replicate the findings but now with a larger sample size. As in Study 1, we hypothesized that providing participants with knowledge on the science on memory would make them more critical toward the existence of repressed memory and dissociative amnesia.

6 | STUDY 2

6.1 | Method

6.1.1 | Participants

Participants were students from the Faculty of Law and Criminology, KU Leuven following a Master's degree course on Legal Psychology[6]. The course was taught by the first author. In this study, 555 were registered and 108 students (mean age = 21.32, *SD* = .96, range: 20–25; 85 female) completed both surveys at Time 1 and 2. The attrition rate might be caused because of the similar reason as in Study 1 (i.e., coronavirus pandemic resulting in a main focus on online learning). Of the 555 registered responses, 237 completed the first survey. Their mean age (M_{age} = 21.30, *SD* = 1.23) did not statistically differ from the students who completed both surveys ($t(343) = .22$, $p = .83$, Cohen's $d = .02$).

6.1.2 | Materials

Statements

The same statements were used as in Study 1.

Course on legal psychology

Participants followed a course (in Dutch) on legal psychology that starts every semester at the end of September/ beginning of October to the end of December 2020. Students received 3 h of weekly lectures and workshops on diverse topics related to legal psychology

TABLE 1 Means and standard deviations of belief ratings at Time 1 and 2 (Study 1)

	Time 1		Time 2	
Statement	***M***	***SD***	***M***	***SD***
Memory is capable of unconsciously "blocking out" memories of traumatic events	5.35	1.46	3.50	1.93
Dissociative amnesia is caused by an overwhelming amount of stress	5.00	1.03	3.70	1.46
Dissociative amnesia is an essential human response to traumatic events, such as combat, crimes, natural disasters, rape, and childhood abuse	4.40	1.31	2.50	1.43
Most of the time memories that were previously blocked resurface after recovering from dissociative amnesia	3.90	1.12	2.65	1.46
People suffering from dissociative amnesia can develop one or more new identities	4.40	1.00	3.65	1.69
Repressed memories of events that did happen can be retrieved in therapy accurately	3.95	1.43	1.80	.95
Hypnosis can accurately retrieve memories of events that did happen, but were previously not known to the client/patient.	3.30	1.22	1.80	1.15
People suffering from dissociative amnesia forget how to use common objects, such as forks, computers or cars	2.85	1.27	1.75	.97
People who commit severe and violent crimes can develop dissociative amnesia for those events	4.85	.99	3.75	1.59
People suffering from dissociative amnesia are unaware of their amnesia	3.95	.83	3.25	1.25
People suffering from dissociative amnesia cannot recall their own birthday	3.25	1.33	2.10	1.07
Memory of everything experienced is stored permanently in the brain, even if we cannot access all of it	3.75	1.52	2.10	1.29
Growing up in an emotionally abusive environment leads people to developing dissociative amnesia	4.70	1.03	3.35	1.18
People with dissociative amnesia do not remember most of their life	2.40	.94	1.90	.72
People with dissociative amnesia usually have impairment in all aspects of functioning	3.15	1.14	2.20	1.15
A poor memory for childhood events is indicative of a traumatic childhood	2.80	1.54	1.60	1.05
Therapy helps people with dissociative amnesia to recover their buried memories	4.25	.97	2.60	1.47
Dissociative amnesia is an innate capacity of the brain to expel traumatic memories from consciousness	4.25	1.37	3.50	1.82
Dissociative amnesia can be viewed as a blocking mechanism	5.05	.89	4.30	1.46
Dissociative amnesia is a natural phenomenon that has been documented throughout history	4.00	1.30	3.10	1.41
When someone has a memory of a trauma while in hypnosis, it objectively must have occurred	2.60	1.54	1.45	.83
Unconscious memories of trauma such as abuse can lead to depressive symptoms	5.40	.94	3.80	1.40
Memories of traumatic events such as abuse can be inaccessible for many years waiting to be recovered	4.75	1.25	2.70	1.49

(e.g., investigative interviewing, expert witnesses, biases). Of importance for the current study were lectures specifically focused on eyewitness memory, false memory, and trauma and memory functioning. Because of the COVID-19 pandemic, some lectures were provided online.

6.1.3 | Design and procedure

The same design and procedure were applied as in Study 1.

7 | RESULTS AND DISCUSSION

Paired samples *t*-tests were conducted to examine whether students became more critical regarding repressed memory and dissociative amnesia after receiving education on these topics. Tables 3 and 4 provide the statistics (e.g., means, effect sizes) of these analyses. As can be noticed, all comparisons were statistically significant with effect sizes ranging between .75–2.48. These effects remained statistically significant when a stricter significance level was used to account for multiple comparisons (=.002). Thus, using a larger sample size, we found a similar pattern of data as in Study 1. That is, when students did not have any detailed knowledge on repressed memory and dissociative amnesia, they were more likely to agree that repressed memories and dissociative amnesia exist. However, after they received education on the science of memory, they were less likely to endorse statements on repressed memory and dissociative amnesia.

Thus, based on Studies 1 and 2, controversial beliefs on repressed memory and dissociative amnesia can be changed. In Study 3, we wanted to take this research one step further. Although we once more aimed to replicate the findings from the previous studies, we were

TABLE 2 Paired samples *t*-test statistics of belief ratings at Time 1 and 2 (Study 1)

Statement	*t*	*df*	*p*	Cohen's *d*
Memory is capable of unconsciously "blocking out" memories of traumatic events	3.430	19	.001	.767
Dissociative amnesia is caused by an overwhelming amount of stress	3.266	19	.002	.730
Dissociative amnesia is an essential human response to traumatic events, such as combat, crimes, natural disasters, rape, and childhood abuse	5.596	19	<.001	1.251
Most of the time memories that were previously blocked resurface after recovering from dissociative amnesia	3.324	19	.002	.743
People suffering from dissociative amnesia can develop one or more new identities	1.702	19	.052	.381
Repressed memories of events that did happen can be retrieved in therapy accurately	7.130	19	<.001	1.594
Hypnosis can accurately retrieve memories of events that did happen, but were previously not known to the client/patient.	5.627	19	<.001	1.258
People suffering from dissociative amnesia forget how to use common objects, such as forks, computers or cars	3.488	19	.001	.780
People who commit severe and violent crimes can develop dissociative amnesia for those events	3.168	19	.003	.708
People suffering from dissociative amnesia are unaware of their amnesia	3.199	19	.002	.715
People suffering from dissociative amnesia cannot recall their own birthday	3.217	19	.002	.719
Memory of everything experienced is stored permanently in the brain, even if we cannot access all of it	3.343	19	.002	.748
Growing up in an emotionally abusive environment leads people to developing dissociative amnesia	3.563	19	.001	.797
People with dissociative amnesia do not remember most of their life	2.517	19	.010	.563
People with dissociative amnesia usually have impairment in all aspects of functioning	2.967	19	.004	.664
A poor memory for childhood events is indicative of a traumatic childhood	4.660	19	<.001	1.042
Therapy helps people with dissociative amnesia to recover their buried memories	5.638	19	<.001	1.261
Dissociative amnesia is an innate capacity of the brain to expel traumatic memories from consciousness	1.924	19	.035	.430
Dissociative amnesia can be viewed as a blocking mechanism	1.994	19	.030	.446
Dissociative amnesia is a natural phenomenon that has been documented throughout history	2.854	19	.005	.638
When someone has a memory of a trauma while in hypnosis, it objectively must have occurred	3.929	19	<.001	.879
Unconscious memories of trauma such as abuse can lead to depressive symptoms	4.000	19	<.001	.894
Memories of traumatic events such as abuse can be inaccessible for many years waiting to be recovered	6.245	19	<.001	1.396

also interested to investigate what people really mean when they indicate to believe in repressed memory and dissociative amnesia. So, in Study 3, when participants agreed with certain statements (e.g., "Therapy can help people with dissociative amnesia to recover their buried memories"), follow up questions (e.g., Therapists should look for any type of psychological stressor in their patients' life) were asked to examine more closely people's ideas behind the topic of repressed memory and dissociative amnesia.

Furthermore, in Study 3, we also provided participants with a case vignette in which a person recovers a memory during therapy which she did not have before therapy. We inserted this case vignette to examine whether people's beliefs might also transfer to when people are confronted with a possible case of recovered memories. The use of case vignettes has been applied before in research on beliefs in repressed memory. For example, Houben et al. (2021) provided clinicians using Eye Movement Desensitization and Reprocessing (EMDR) therapy with a case vignette in which a patient recovered a memory during the course of treatment which the patient did not have before therapy. Houben et al. found that 75% ($n = 9$) of the EMDR practitioners indicated that it was (very) likely that the recovered memory referred to an authentic experience. What we do not know is whether people become more critical to label therapy-induced recovered memories as true memories when they receive education on the science of memory.

Thus, the aims of Study 3 were the following. First, we wanted to replicate the results obtained in Studies 1 and 2. Second, our interest was to dig more deeply in people's beliefs concerning repressed memory and dissociative amnesia by asking additional follow-up questions. As in the previous studies, we expected that participants would believe less in repressed memory and dissociative amnesia after receiving scientific knowledge on the functioning of memory. Third, we included a case vignette on therapy-induced recovered memories and predicted that students would be more likely to label such memories as potentially false after receiving teaching in memory science.

TABLE 3 Means and standard deviations of belief ratings at Time 1 and 2 (Study 2)

	Time 1		Time 2	
Statement	***M***	***SD***	***M***	***SD***
Memory is capable of unconsciously "blocking out" memories of traumatic events	5.87	1.01	1.93	1.22
Dissociative amnesia is caused by an overwhelming amount of stress	5.28	.85	2.56	1.46
Dissociative amnesia is an essential human response to traumatic events, such as combat, crimes, natural disasters, rape, and childhood abuse	5.24	.99	2.01	1.21
Most of the time memories that were previously blocked resurface after recovering from dissociative amnesia	4.79	1.17	2.01	1.13
People suffering from dissociative amnesia can develop one or more new identities	4.69	.94	2.33	1.29
Repressed memories of events that did happen can be retrieved in therapy accurately	5.16	.99	2.18	1.34
Hypnosis can accurately retrieve memories of events that did happen, but were previously not known to the client/patient.	4.63	1.05	1.92	.99
People suffering from dissociative amnesia forget how to use common objects, such as forks, computers or cars	3.71	1.22	1.72	1.00
People who commit severe and violent crimes can develop dissociative amnesia for those events	5.28	1.03	2.35	1.49
People suffering from dissociative amnesia are unaware of their amnesia	4.65	1.23	3.25	1.45
People suffering from dissociative amnesia cannot recall their own birthday	2.97	1.15	1.85	1.00
Memory of everything experienced is stored permanently in the brain, even if we cannot access all of it	4.14	1.59	1.88	1.67
Growing up in an emotionally abusive environment leads people to developing dissociative amnesia	5.05	1.08	2.49	1.42
People with dissociative amnesia do not remember most of their life	2.68	.96	1.85	.95
People with dissociative amnesia usually have impairment in all aspects of functioning	2.94	1.14	1.84	.92
A poor memory for childhood events is indicative of a traumatic childhood	3.19	1.36	1.64	.81
Therapy helps people with dissociative amnesia to recover their buried memories	5.47	.78	2.07	1.30
Dissociative amnesia is an innate capacity of the brain to expel traumatic memories from consciousness	4.82	1.18	2.19	1.19
Dissociative amnesia can be viewed as a blocking mechanism	5.70	.74	2.70	1.55
Dissociative amnesia is a natural phenomenon that has been documented throughout history	4.47	1.20	2.36	1.55
When someone has a memory of a trauma while in hypnosis, it objectively must have occurred	2.85	1.05	1.49	.070
Unconscious memories of trauma such as abuse can lead to depressive symptoms	5.73	.73	3.22	1.63
Memories of traumatic events such as abuse can be inaccessible for many years waiting to be recovered	5.53	1.03	2.42	1.55

8 | STUDY 3

8.1 | Method

8.1.1 | Participants

279 students were registered in the class and of these 58 students completed both surveys. Participants were undergraduate students from the Faculty of Law and Criminology, KU Leuven following a course on Criminological Psychology. The course was taught by the first author. The attrition rate could have occurred because of the similar reason as in Studies 1 and 2 (i.e., corona pandemic resulting in a main focus on online learning). Of the 279 students, 160 completed the first survey. Their mean age ($M_{age} = 19.01$, $SD = 2.25$) did not statistically differ from students completed both surveys ($t(216) = .22$, $p = .82$, Cohen's $d = .04$).

8.1.2 | Materials

Statements

Although the same statements were used as in Studies 1 and 2, for some statements, we included additional follow up questions (see Tables 5 and 6). Also, for exploratory purposes, we included additional statements related to repressed memory and appraising memories of emotion. These new statements were added because of recent work showing that cognitive reappraisals can alter memories for emotions (Patihis, Cruz, et al., 2019).

Case vignette

Participants received a case vignette (193 words; see https://osf.io/swn28/) about a young woman undergoing therapy where she recovered a memory concerning sexual abuse that she did not have before therapy. After reading the case vignette, participants were asked

TABLE 4 Paired samples *t*-test statistics of belief ratings at Time 1 and 2 (Study 2)

Statement	*t*	*df*	*p*	Cohen's *d*
Memory is capable of unconsciously "blocking out" memories of traumatic events	25.726	107	<.001	2.475
Dissociative amnesia is caused by an overwhelming amount of stress	16.849	107	<.001	1.621
Dissociative amnesia is an essential human response to traumatic events, such as combat, crimes, natural disasters, rape, and childhood abuse	22.845	107	<.001	2.198
Most of the time memories that were previously blocked resurface after recovering from dissociative amnesia	16.942	107	<.001	1.630
People suffering from dissociative amnesia can develop one or more new identities	14.729	107	< .001	1.417
Repressed memories of events that did happen can be retrieved in therapy accurately	18.031	107	<.001	1.735
Hypnosis can accurately retrieve memories of events that did happen, but were previously not known to the client/patient.	20.721	107	<.001	1.994
People suffering from dissociative amnesia forget how to use common objects, such as forks, computers or cars	14.020	107	<.001	1.349
People who commit severe and violent crimes can develop dissociative amnesia for those events	16.545	107	<.001	1.592
People suffering from dissociative amnesia are unaware of their amnesia	7.815	107	< .001	.752
People suffering from dissociative amnesia cannot recall their own birthday	8.322	107	<.001	.801
Memory of everything experienced is stored permanently in the brain, even if we cannot access all of it	13.080	107	<.001	1.259
Growing up in an emotionally abusive environment leads people to developing dissociative amnesia	15.487	107	<.001	1.490
People with dissociative amnesia do not remember most of their life	7.241	107	<.001	.697
People with dissociative amnesia usually have impairment in all aspects of functioning	8.832	107	<.001	.850
A poor memory for childhood events is indicative of a traumatic childhood	23.586	107	<.001	2.270
Therapy helps people with dissociative amnesia to recover their buried memories	16.037	107	<.001	1.543
Dissociative amnesia is an innate capacity of the brain to expel traumatic memories from consciousness	18.938	107	<.001	1.822
Dissociative amnesia can be viewed as a blocking mechanism	11.756	107	<.001	1.131
Dissociative amnesia is a natural phenomenon that has been documented throughout history	12.414	107	<.001	1.195
When someone has a memory of a trauma while in hypnosis, it objectively must have occurred	14.439	107	<.001	1.389
Unconscious memories of trauma such as abuse can lead to depressive symptoms	19.098	107	<.001	1.838
Memories of traumatic events such as abuse can be inaccessible for many years waiting to be recovered	10.539	107	<.001	1.014

whether (1) the young woman's memories were repressed and accurately recovered in therapy, (2) the memories of abuse reflected an event that she truly experienced, (3) the memories of abuse reflected an event that she did not experience and was false, and (4) she unconsciously forgot memories of the abuse to cope with the trauma. Participants had to answer these questions by using 7-point Likert scales (1 = strongly disagree, 7 = strongly agree).

Course on criminological psychology

Participants followed a course (in Dutch) on Criminological Psychology that starts every second semester at the end of January/beginning of February to the end of May[7] 2021. Students received weekly lectures and workshops of 4 h on diverse topics related to legal psychology (e.g., false confessions, investigative interviewing, expert witnesses, and criminal behavior). Of importance for the current studies were lectures specifically focused on eyewitness memory, false memory, and trauma and memory. Because of the COVID-19 pandemic, some lectures were online.

8.1.3 | Design and procedure

The same design and procedure were applied as in Studies 1 and 2, except for the case vignette provided to participants after having received the statements (prior to the course and after the course). Also, participants only received the follow-up questions when they agreed with the respective statements (i.e., they provided a rating of 5 (somewhat agree), 6 (agree), or 7 (strongly agree)).

9 | RESULTS AND DISCUSSION

9.1 | Memory statements

Paired samples *t*-tests were performed to examine the change in statement ratings before and after receiving a course on Criminological Psychology. Tables 5 and 6 provide the statistics of these changes. Two important findings emerged. First, as in previous studies, most of

TABLE 5 Means and standard deviations of belief ratings at Time 1 and 2 (Study 3)

Statement	Time 1		Time 2	
	M	*SD*	*M*	*SD*
Memory is capable of unconsciously "blocking out" memories of traumatic events	5.19	1.33	2.93	1.65
People who do unconsciously "blocking out" memories will be unaware that they experienced a trauma ($n^* = 47$, $n = 16$)	4.45	1.23	3.37	1.54
Dissociative amnesia is caused by an overwhelming amount of stress	4.72	.87	3.21	1.55
High levels of stress, such as stress experienced during sexual abuse, can make people repress and forget the abuse ($n^* = 37$, $n = 16$)	4.84	1.57	3.75	1.92
Dissociative amnesia is an essential human response to traumatic events, such as combat, crimes, natural disasters, rape, and childhood abuse	4.91	1.10	2.95	1.57
It is possible that most of the time memories that were previously blocked resurface after recovering from dissociative amnesia	5.12	.88	2.57	1.61
People suffering from dissociative amnesia can develop one or more new identities	4.76	.92	2.97	1.44
Repressed memories of traumatic events can be retrieved in therapy accurately	5.16	.93	2.48	1.53
Hypnosis can accurately retrieve memories of events that did happen, but were previously not known to the client/patient	4.83	1.11	2.36	1.40
People suffering from dissociative amnesia forget how to use common objects, such as forks, computers, or cars	3.50	1.20	2.52	1.42
People who commit severe and violent crimes can develop dissociative amnesia for those events	4.91	1.16	3.19	1.68
People suffering from dissociative amnesia are unaware of their amnesia	4.38	1.11	3.45	1.49
People suffering from dissociative amnesia cannot recall their own birthday	3.55	1.14	2.19	1.08
Memory of everything experienced is stored permanently in the brain, even if we cannot access all of it	4.50	1.44	2.47	1.43
Growing up in an emotionally abusive environment leads people to developing dissociative amnesia	4.83	.84	3.19	1.37
People with dissociative amnesia do not remember most of their life	3.14	.96	2.07	.92
People with dissociative amnesia usually have impairments in all aspects of functioning	3.76	1.03	2.45	1.10
A poor memory for childhood events is indicative of a traumatic childhood	3.76	1.20	2.26	1.12
Therapy can help people with dissociative amnesia to recover their buried memories	5.50	.68	2.72	1.64
Therapists should look for any type of psychological stressor in their patients' life ($n^* = 56$, $n = 11$)	5.30	.87	4.73	.79
Dissociative amnesia is an innate capacity of the brain to expel traumatic memories from consciousness	4.86	1.05	2.83	1.44
The brain expels traumatic memories automatically without people consciously being aware of it ($n^* = 33$, $n = 10$)	5.52	1.00	3.80	1.40
Dissociative amnesia can be viewed as a blocking mechanism	5.41	.84	3.79	1.67
The inability to remember the past is a psychological form of coping with the trauma ($n^* = 52$, $n = 27$)	4.96	1.15	3.89	1.42
Dissociative amnesia is a natural phenomenon that has been documented throughout history	4.60	1.17	3.34	1.64
Dissociative amnesia, like other psychological phenomena (e.g., hallucinations, depression, anxiety, and dementia), appears in written books throughout ages ($n^* = 29$, $n = 18$)	5.07	.96	4.22	1.11
When someone has a memory of a trauma while in hypnosis, it objectively must have occurred	3.72	1.24	1.97	1.11
Unconscious memories of trauma, such as abuse, can lead to depressive symptoms	5.71	.75	4.40	1.54
Memories of traumatic events, such as abuse, can be inaccessible for many years waiting to be recovered	5.52	.80	3.19	1.55
Memories of traumatic events are automatically made inaccessible by the brain until individuals are ready to recover the memory ($n^* = 52$, $n = 12$)	3.56	1.16	2.75	1.29
Memories of emotion that you felt in childhood will be accurate[#]	4.34	1.21	2.78	1.33
Memories of the emotions you felt in childhood will not change over time	3.17	1.24	2.67	1.41
Memories of emotions you felt previously can change if your appraisal of the past situation changes	5.12	1.08	5.03	1.18
It is possible to not feel any distress during an event, but then years later to misremember being distressed during that event	5.09	1.05	5.03	1.21

Note: Statements in italics refer to the follow-up questions, *first *n* refers to the number of subjects answering this question at Time 1, the second *n* refers to the number of participants answering it at Time 2, #these last statements were new statements on memory or emotion malleability.

TABLE 6 Paired samples *t*-test statistics of belief ratings at Time 1 and 2 (Study 3)

Statement	*t*	*df*	*p*	Cohen's *d*
Memory is capable of unconsciously "blocking out" memories of traumatic events	7.611	57	<.001	.999
People who do unconsciously "blocking out" memories will be unaware that they experienced a trauma (n = 47, n = 16)	2.461	11	.016	.71
Dissociative amnesia is caused by an overwhelming amount of stress	6.643	57	<.001	.872
High levels of stress, such as stress experienced during sexual abuse, can make people repress and forget the abuse (n = 37, n = 16)	3.557	11	.002	1.027
Dissociative amnesia is an essential human response to traumatic events, such as combat, crimes, natural disasters, rape, and childhood abuse	8.288	57	<.001	1.361
It is possible that most of the time memories that were previously blocked resurface after recovering from dissociative amnesia	10.366	57	<.001	1.361
People suffering from dissociative amnesia can develop one or more new identities	9.511	57	<.001	1.249
Repressed memories of traumatic events can be retrieved in therapy accurately	12.432	57	<.001	1.632
Hypnosis can accurately retrieve memories of events that did happen, but were previously not known to the client/patient	12.608	57	<.001	1.655
People suffering from dissociative amnesia forget how to use common objects, such as forks, computers, or cars	3.890	57	<.001	.511
People who commit severe and violent crimes can develop dissociative amnesia for those events	6.405	57	<.001	.841
People suffering from dissociative amnesia are unaware of their amnesia	4.852	57	<.001	.637
People suffering from dissociative amnesia cannot recall their own birthday	7.228	57	<.001	.949
Memory of everything experienced is stored permanently in the brain, even if we cannot access all of it	8.400	57	<.001	1.103
Growing up in an emotionally abusive environment leads people to developing dissociative amnesia	7.604	57	<.001	.998
People with dissociative amnesia do not remember most of their life	6.799	57	<.001	.893
People with dissociative amnesia usually have impairments in all aspects of functioning	7.445	57	<.001	.978
A poor memory for childhood events is indicative of a traumatic childhood	6.939	57	<.001	.911
Therapy can help people with dissociative amnesia to recover their buried memories	12.385	57	< .001	1.626
Therapists should look for any type of psychological stressor in their patients' life (n = 56, n = 11)	1.000	9	.172	.316
Dissociative amnesia is an innate capacity of the brain to expel traumatic memories from consciousness	8.579	57	<.001	1.126
The brain expels traumatic memories automatically without people consciously being aware of it (n = 33, n = 10)	2.011	5	.050	.821
Dissociative amnesia can be viewed as a blocking mechanism	6.562	57	<.001	.862
The inability to remember the past is a psychological form of coping with the trauma (n = 52, n = 27)	2.918	24	.004	.584
Dissociative amnesia is a natural phenomenon that has been documented throughout history	4.567	57	<.001	.600
Dissociative amnesia, like other psychological phenomena (e.g., hallucinations, depression, anxiety and dementia), appears in written books throughout ages (n = 29, n = 18)	2.198	7	.032	.777
When someone has a memory of a trauma while in hypnosis, it objectively must have occurred	9.528	57	<.001	1.251
Unconscious memories of trauma, such as abuse, can lead to depressive symptoms	5.806	57	<.001	.762
Memories of traumatic events, such as abuse, can be inaccessible for many years waiting to be recovered	10.182	57	<.001	1.337
Memories of traumatic events are automatically made inaccessible by the brain until individuals are ready to recover the memory (n = 52, n = 12)	2.654	10	.012	.800
Memories of emotion that you felt in childhood will be accurate[#]	7.172	57	<.001	.942
Memories of the emotions you felt in childhood will not change over time	2.189	57	.016	.287
Memories of emotions you felt previously can change if your appraisal of the past situation changes	.401	57	.345	.053
It is possible to not feel any distress during an event, but then years later to misremember being distressed during that event	.239	57	.406	.031

Note: Italic indicatices follow-up statements.

the comparisons between Time 1 and 2 were statistically significant when a stricter significance level was applied (=.002). Second, 5 of the 7 follow up questions also produced statistically significant effects. Importantly, the number of participants receiving the follow up questions was substantially lower at Time 2 (i.e., more than half of a reduction) than at Time 1.

9.2 | Case vignette

We also examined participants' responses to the case vignette statements (see Tables 7 and 8). All statements showed statistically significant effects. Overall, our results replicated what we detected in Studies 1 and 2. However, what Study 3 added were the following two findings. First, fewer participants received the follow-up questions at Time 2 than at Time 1 showing that agreement ratings overall dropped when survey was completed the second time. Second, participants became critical toward the content of the case vignette by showing lower agreement ratings at Time 2 than at Time 1.

9.3 | Exploratory correlational and joint analysis

To explore whether ratings on statements on repressed memory and dissociative amnesia were correlated, we created a composite score of statements on repressed memory and a composite score of dissociative amnesia statements. Specifically, the composite score was calculated by averaging all respective statements. For Study 1, we found that at Time 1, no statistically significant correlation emerged between the repressed memory composite and the dissociative amnesia composite ($r(19) = .41$, $p = .07$). However, at Time 2, a statistically significant correlation was detected ($r(19) = .75$, $p < .001$). For Study 2, at Time 1 and Time 2, a statistically significant correlation emerged (Time 1: $r(107) = .55$, $p < .001$; Time 2: $r(107) = .77$, $p < .001$). A similar pattern of correlations was also observed in Study 3 (Time 1: $r(57) = .27$, $p = .04$; Time 2: $r(57) = .73$, $p < .001$).

Also, to explore the size of the obtained effects in the present studies, we conducted a joint analysis on the observed effect sizes of the studies. When we averaged all effect sizes ($n = 69$) for the same statements that were provided across studies, we obtained a Cohen's d of 1.13 ($SD = .47$). We also compared the mean effect sizes between belief scores regarding statements on repressed memory ($n = 24$) and statements on dissociative amnesia ($n = 45$). An independent samples t-test was performed with effect sizes as dependent variable and whether they referred to statements on repressed memory or dissociative amnesia as between-subjects factor. A statistically significant effect was detected, ($t(67) = 2.92$, $p = .005$, Cohen's $d = .74$) with Cohen's ds being higher for statements on repressed memory ($M = 1.34$, $SD = .48$) than for statements on dissociative amnesia ($M = 1.02$, $SD = .42$).

10 | GENERAL DISCUSSION

Can controversial beliefs in repressed memory and dissociative amnesia be changed? The answer to this question is yes. In the current line of studies, students had to rate their beliefs concerning a diverse set

TABLE 7 Means and standard deviations of case vignette statements at Time 1 and 2 (Study 3)

	Time 1		Time 2	
Case vignette statement	***M***	***SD***	***M***	***SD***
Kelly's memories were repressed and accurately recovered in therapy	5.17	1.22	2.69	1.60
Kelly's memories of abuse reflect an event that she truly experienced	4.72	1.23	2.66	1.19
Kelly's memories of abuse reflect an event that she did not experience and is false	3.41	1.30	5.19	1.24
Kelly unconsciously forgot memories of the abuse so to cope with the trauma	5.10	1.07	2.91	1.38

TABLE 8 Paired samples t-test statistics of case vignette statements at Time 1 and 2 (Study 3)

Statement	*t*	*df*	*p*	Cohen's *d*
Kelly's memories were repressed and accurately recovered in therapy	10.510	57	<.001	1.380
Kelly's memories of abuse reflect an event that she truly experienced	10.445	57	<.001	1.371
Kelly's memories of abuse reflect an event that she did not experience and is false	−7.739	57	<.001	−1.016
Kelly unconsciously forgot memories of the abuse so to cope with the trauma	9.466	57	<.001	1.243

of statements related to repressed memory and dissociative amnesia. After this, they received education on—among others—the science behind repressed memory and dissociative amnesia. Following this, students had to re-rate the same statements. Furthermore, in the third study, participants were presented with additional follow-up questions and a case vignette on recovered memories. Overall, students became more critical toward the concept of repressed memory and dissociative amnesia after receiving education on the science of memory.

The backdrop of the current empirical enterprise is connected to the ongoing controversy surrounding the possibility to unconsciously repress autobiographical traumatic memories (e.g., Otgaar et al., 2019). Although empirical evidence is lacking for the existence of repressed memory, this issue remains endemic in academic, clinical, and legal contexts (e.g., McNally, 2021). Research clearly demonstrated that the belief in the concepts of repressed memory persists among various populations (e.g., students, clinical psychologists, and police officers) (e.g., Dodier et al., 2021; Sumampouw et al., 2022). Such studies present informative data on the widespread nature of repressed memory but are insofar limited as they merely present a static pattern of belief rates.

In the current studies, we replicated the finding that students strongly agree with the idea of repressed memory and dissociative amnesia. Most importantly, however, our findings offer some new contributions to the controversy on repressed memory. First, we showed that the belief in repressed memory and dissociative amnesia is not static but amenable to change. Specifically, across three studies, when students received scientific knowledge on the functioning of memory, they were less likely to agree with several dimensions related to repressed memory and dissociative amnesia. The result that belief ratings dropped at Time 2 after receiving scientific knowledge on the science of memory might be due to the fact that this knowledge made students more informed and critical toward repressed memory, thereby perhaps shifting from an automatic to a more controlled mode of thinking (see e.g., Lilienfeld et al., 2009). However, this is speculation because we did not have any measurement to support the proposition that there was a switch from an automatic to a more controlled thinking. What could have happened is that after receiving education on the science of memory, participants could mobilize more knowledge concerning the topic of repressed memory and dissociative amnesia and therefore make better judgments. Second, our main finding is well in line with the results obtained in Sauerland and Otgaar's study (2022) but extends them in that (1) we also focused on statements on dissociative amnesia and (2) we included more statements assessing different dimensions of repressed memory. Our results demonstrated a more critical attitude toward all statements after receiving knowledge on the science of memory.

Third, in Study 3, students that agreed with several statements on repressed memory and dissociative amnesia received follow-up questions to better understand what they meant with the concept of dissociative amnesia. The number of students receiving such follow-up questions was substantially lower at Time 2 than at Time 1. This indicates that at Time 2, fewer students agreed with certain statements on repressed memory and dissociative amnesia in the first place than at Time 1. Moreover, we found that follow-up statements received lower agreement rates at Time 2 than at Time 1. Taken together, these data showed that when more specific and detailed questions concerning repressed memory and dissociative amnesia were asked, students became more critical toward agreeing with them after receiving scientific knowledge on memory functioning.

Fourth, we also included a case vignette (Study 3) in which students had to read a case about a young person recovering a memory of sexual abuse during therapy. The rationale of inserting this case vignette was to examine whether students could apply their knowledge on memory in order to more critically evaluate this case. So, for example, at Time 1, students reading this case highly agreed with the statement that the memories of the person (i.e., Kelly) were repressed and accurately recovered in therapy. However, at Time 2, on average, students were less likely to agree with this statement than at Time 1. This shows that providing students with scientific sources on memory could potentially help them in making better judgments in recovered memory cases.

We also conducted an exploratory joint analysis on the effect sizes obtained in the current studies. We observed a Cohen's d of 1.13 across all studies and statements. This implies that about 85% of the Time 2 data is above the average of the mean of the Time 1 data (i.e., Cohen's U_3; Magnusson, 2021). Notably, we also found that when we compared the effect sizes of repressed memory statements with dissociative amnesia statements, the mean effect size was larger for the repressed memory (Cohen's $d = 1.34$) than dissociative amnesia statements (Cohen's $d = 1.02$). This suggests that the offered education was more effective in making students critical about repressed memory than dissociative amnesia. There are two explanations for this finding. First, students received more information concerning the controversial topic of repressed memory than of dissociative amnesia. Second, and relatedly, the concept of dissociative amnesia might have been more difficult to grasp than repressed memory because it is also strongly related to the field of mental disorders (e.g., Staniloiu & Markowitsch, 2014) which might have been more difficult to comprehend for students following a course at a law faculty.

We also performed exploratory correlational analyses between ratings on repressed memory and dissociative amnesia statements. An underlying reason for these analyses was to examine whether people regard the concept of repressed memory equivalent to dissociative amnesia; something that has been foreshowed by several scholars (e.g., Mangiulli et al., 2022; McNally, 2005; Otgaar et al., 2019; Porter et al., 2001). By creating composite scores, we indeed found evidence for this. Specifically, overall, we found that people who believed in the concept of repressed memory also believed in the concept of dissociative amnesia. Although the correlations of this pattern were higher at Time 2 and thus after receiving knowledge about the link between repressed memory and dissociative amnesia, this link was also evident at Time 1.

10.1 | Limitations and future research

Although the current results are promising, there are some imperative empirical avenues ahead. One issue is whether a control group would be necessary in future research. It will be difficult to randomly assign some students to a control group university course, and it is anyway questionable whether the changes in beliefs about repressed memory could be caused by maturation or other factors (other than the presentation of memory evidence). Demand characteristics are perhaps the most plausible confound, but a control group may not isolate that potential confound. The anonymous nature of the current studies' questionnaires, as well as the follow up timepoints and the absence of any compensation for the participants, hopefully negated any serious demand characteristics.

In addition, both in Sauerland and Otgaar's study (2022) and in the current studies, students received an extensive course across 2 months. It would be important to examine whether such belief changes can also be targeted in people who are perhaps more intrinsically prone to endorse such controversial beliefs (e.g., clinical psychologists). However, it is unlikely that people belonging to some of these groups are able to follow extensive courses in parallel to their daily practice. Hence, it is an empirical question whether belief changes in repressed memory and dissociative amnesia also happen when shorter courses are applied. In our opinion, a course on scientific research regarding trauma and memory, repressed memory, and the fallibility of memory could potentially be sufficient to change beliefs. For example, in the Netherlands, therapists sometimes receive shorter courses or workshops on the functioning of memory.[8] At present, however, it is unclear whether they are effective in belief corrections or changes as well. Furthermore, another important research opportunity is to examine the longevity of the current findings after long delays such as a year. However, based on Sauerland and Otgaar's study (2022) that found that their belief reductions lasted up to 18 months, there are no a priori reasons to believe why this would not also happen when more statements on repressed memory and dissociative amnesia are used as in the present studies.

Furthermore, due to the COVID-19 pandemic, many lectures had to be given online and because of a lack of personal contact, it was challenging to stimulate participants to complete all sessions of the surveys. That is, the current studies were advertised on the digital learning space of the students; a place where many other teaching-related announcements are placed (e.g., about the literature of a given lecture). Because there was less opportunity to personally motivate students during on-campus lectures, this likely contributed to the high attrition rates of the current studies. However, there were some indications that students dropping out did not differ on certain dimensions (i.e., mean age) from students completing both sessions of the experiment, implying that the current results provide a good estimate of what happens in the population. Furthermore, follow up studies (Studies 2 and 3) used larger sample sizes and replicated the effects detected in Study 1.

Also, it might be fruitful to examine whether similar results occur when at Time 2 somewhat different variations of the same statements were applied. For example, instead of stating "Traumatic memories can be unconsciously repressed," one could also include "Traumatic memories cannot be unconsciously repressed." These variations might test whether participants are able to use their acquired knowledge when being confronted with completely new statements. Furthermore, such variations might protect from the possibility that, at Time 2, participants remember the statements and what they answered at Time 1. However, in the current studies, it is unlikely that because of the high number of statements and the long delay between Time 1 and Time 2 (i.e., about 3 months), participants would have remembered the exact content and their answers at Time 1.

Although the current samples did not consist of clinical psychologists, the tested participants were students from a law faculty. It is unlikely that they will become practitioners in clinical settings, but arguably they will work in legal settings as for example lawyers or judges. This is important as the topic of repressed memory also thrives in legal settings. For example, Benton et al. (2006) showed that 50% ($n = 25$) of the judges in their sample believed in the concept of repressed memory. Why this is dangerous is because in some countries such as France, the period (i.e., statute of limitations) to prosecute sexual crimes has been extended because legal scholars stipulated that traumatic memories can be repressed for many years (Dodier & Tomas, 2019). Therefore, given that the concepts of dissociative amnesia and repressed memory are (re)emerging in the courtroom (see Otgaar et al., 2019), it is imperative for future legal professionals to be aware of such controversial ideas and their possible consequences. Of course, prospective research should focus on replicating the current results with other groups such as clinicians or judges.

Finally, although there is a developing research area on misinformation belief and its corrections (e.g., Ecker et al., 2022), research attempting to correct beliefs in repressed memory and dissociative amnesia is currently limited. However, because of the clear applied relevance of doing such work in this area (e.g., lowering chance for false recovered memories in therapy), future research could focus on the causes of believing in repressed memory and dissociative amnesia and which mechanisms underlie the current observed belief changes. For example, research could examine whether the belief in repressed memory is linked to "the illusory truth effect" (e.g., Henderson et al., 2022) wherein people start to believe in repressed memories because of repeated (false) exposure of its existence (e.g., due to movies, newspapers, etc.). Furthermore, research could focus on whether the observed belief changes of the current studies are partly caused by participants believing in the content of the lectures (e.g., Rich et al., 2017). Finally, the concept of repressed memory is perhaps sometimes more difficult to debunk than plain fake news, as this latter one is more likely to be easily identified as false. Hence, future research enterprises might examine whether this also implies that stronger corrective measures are necessary to "completely" eradicate the belief in repressed memory.

To recap, scholars have sometimes argued that research on the belief in repressed memory is limited as it has exclusively focused on a narrow set of statements (Brewin et al., 2020). In the current

studies, we have shown that high agreement ratings exist when a wide variety of statements are used assessing various aspects of repressed memory and dissociative amnesia. More importantly, we have revealed that beliefs in repressed memory and dissociative amnesia are not stable and can be changed. This is encouraging because it might pave the way for other effective methods to debias people's beliefs in repressed memory and dissociative amnesia. Our work further suggests that when expert witnesses are involved in cases on repressed memory, they could educate the court on the controversial aspects of repressed memory and dissociative amnesia. Such education could potentially lead to a more critical attitude among legal professionals concerning these concepts. Eventually, such corrective methods might help in lowering the chance of false accusations and wrongful convictions based on repressed memory and dissociative memory loss.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

All data can be found on the Open Science Framework: https://osf.io/f6png/.

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ENDNOTES

[1] See for a course description: https://onderwijsaanbod.kuleuven.be/syllabi/e/C09C2AE.htm#activetab=doelstellingen_idm9691792

[2] Sauerland & Otgaar: Study 1: $M_{diff} = 1.88$, $SD_{diff} = 0.13$, Cohen's $d = 14.46$, Study 2: $M_{diff} = 1.66$, $SD_{diff} = 0.06$, Cohen's $d = 28.17$

[3] We also conducted a sensitivity power analysis (means: matched pairs), power = 0.80, and a sample of 20 (two-tailed) which showed that this sample could detect effects of a Cohen's $d = 0.66$. This effect is in line with effects detected in the current study.

[4] In Experiment 1, no participant failed the attention checks across the two sessions. In Experiment 2, four participants failed one attention check solely during the first session. Finally, in Experiment 3, nine participants failed at least one attention check during the first session, while only one person failed it during the final one. Data from participants who failed the attention checks were excluded from the analyses.

[5] Some analyses showed a violation of normality. Hence, we also performed Wilcoxon non-parametric signed rank tests. Since the pattern of results of these non-parametric tests was similar as the paired-samples *t*-tests, we only report the *t*-test results. However, the non-parametric results can be found on https://osf.io/7c3jt/ (Study 1), https://osf.io/vkaet/ (Study 2), and https://osf.io/t63bq/ (Study 3).

[6] See for a course description: https://onderwijsaanbod.kuleuven.be/syllabi/n/C01B5AN.htm#activetab=doelstellingen_idp3195856

[7] See for a course description: https://onderwijsaanbod.kuleuven.be/syllabi/n/C02A5CN.htm#activetab=doelstellingen_idm2018656

[8] https://www.ntvp.nl/interview-dr-ineke-wessel-over-het-autobiografische-geheugen-in-de-vroege-jeugd/

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APPENDIX A

Specific themes that were taught to students in the different studies.

Study 1:

1. Science, pseudo-science, and myths in legal psychology
2. Basic psychological insights relevant to the criminal justice
3. Misinformation and false memories
4. Eyewitness testimony
5. Interviewing and interrogation
6. False confession
7. Crime-related amnesia, dissociative amnesia, and repressed memory
8. Deception detection
9. Experts, trials, and cognitive biases
10. Legal decision making

Study 2:

1. Cases and myths in legal psychology
2. Memory
3. False memory and forgetting
4. Repressed memory and dissociative amnesia
5. False confession
6. Deception detection
7. Crime-related amnesia, dissociative amnesia, and repressed memory
8. Children's disclosure of trauma and child interviewing
9. Expert witness work and cognitive biases

Study 3:

1. History of criminological psychology
2. Research methods in criminological psychology
3. Memory
4. False memory and repressed memory
5. Eyewitness testimony
6. Investigative interviewing
7. Crime-related amnesia, dissociative amnesia, and repressed memory
8. False confession and interrogation
9. Children's disclosure of trauma and child interviewing
10. Psychopathy
11. Expert witness work and cognitive biases