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The Effects of a Two week Reflection-Intention Training Program on Lucid Dream Recall

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Previous research in the field of lucid dreams has contained descriptions of several techniques for inducing lucid dreams, but there have been only a limited number of empirical studies designed to evaluate the effectiveness of these techniques. The present study investigated the effects of a two week training program using the reflection-intention technique which is specifically designed to facilitate both dream and lucid dream frequency and recall. The sample consisted of 20 participants whose dream recall frequency and lucid dream recall frequency were measured on three occasions using a dream questionnaire and a dream journal. The three occasions were: before the lucid dream training program began, during week 1 of the lucid dream training program, and finally at the end of week 2 of the program. A one-way repeated measures analysis of variance showed a significant increase in both dream recall frequency ($F_{2,38} = 22.09, p<.05$) and lucid dream recall frequency ($F_{2,38} = 5.96, p<.05$). However, there are some statistical reservations concerning the small sample and possible subject bias that may weaken the study's external validity. Tentative conclusions are presented concerning the efficiency of the lucid dream training program.

KEY WORDS: Lucid dreams, lucidity, dream recall, reflection-intention technique.

INTRODUCTION

Lucid dreams offer a remarkable opportunity to study the content of dreams. The ability to signal during REM sleep has made lucid dreamers a valuable asset in dream research since the participant can indicate when specific dream images and actions take place (LaBerge, 2000). A celebrated example of the usefulness of lucid dreaming in research is the discovery that the duration for the completion of act during dreaming is equivalent to that in normal waking life (La Berge, 1985). However the successful implementation of a wide scale research strategy using the lucid dream state awaits the development of effective and validated methods of inducing this state in normal individuals.

Perhaps because of the difficulties involved in directly studying dream content, especially the poverty of dream recall, a shift has occurred in sleep research during the last 15 years towards studying the perceptual, cognitive and emotional processes involved in dreaming. The work of Hobson and his colleagues is representative of this shift in defining dreams rather negatively as "mental activity occurring in sleep" characterised by loss of awareness of the self, loss of stable information,, loss of directed thought, reduction in logical reasoning and poor memory within and after the dream (Hobson, 2002 p. 7).

It is however possible that the development of a reliable, an empirically validated and effective technique of inducing lucid dreams, might provide a research tool for bringing dream *content* back into a positive research focus. In designing a study to look at the efficiency of a method of facilitating lucid dreams, it is first necessary to review the various factors which might influence dream recall frequency as well as the occurrence of lucid dreaming.

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The study of dreams is usually performed in a sleep laboratory or in the participant's natural home environment (Schredl, Wittman, Ciric and Götz, 2003). The practical, logistical and economical difficulties involved in studying a large number of participants in a sleep lab environment make this a privilege which is only available for a small number of researchers. The majority are left with the option of relying on the participants' ability to correctly and accurately recall dreams in their home environment. Schredl (2002) has noted that the three different types of methods of recording Dream Recall Frequency (DRF), are: questionnaire scales, dream diaries and laboratory awakenings. Each method has its advantages and disadvantages. Dream questionnaires suffer from possible bias of retrospective estimation of DRF due to erroneous or incomplete recollection while dream diaries and laboratory awakenings minimize incorrect recall but recall is nevertheless specific to that environment. Schredl refers to studies where dream diaries and laboratory awakenings gave a higherDRF, especially for low dream recallers. It may well be that for high dream recallers, there is a ceiling effect where further increase is not possible by using a dream diary, compared with a questionnaire. In order to verify these earlier findings, Schredl found that the difference between the DRF for the questionnaire method and for the dream diary to be non-significant. (with means of 4.62 and 4.06, respectively)

Besides the above measure of DRF defined as the number of daily awakenings in which there was dream recall occurring during a two week period, there are three other measures: A dream questionnaire with a seven point rating scale, the "SF-B" sleep questionnaire with a five point scale, and finally a dream diary kept over a 2 week period. Although the dream diary gave higher scores, this might have been due to a higher expectancy associated with this method and the investigators concluded a "gold standard" of measuring DRF cannot be defined. Instead it is advisable that research studies apply more than one method and several scales for measuring DRF (Schredl et al. 2003).

Turning now to our knowledge about of lucid dreams, a lucid dream can be defined phenomenologically (LaBerge, 1985) as being awake in your dreams but also more physiologically (Hobson (2002) as a form of dissociation in which part of the brain is in the waking state and part of the brain is in the dreaming state. A major advance in the study of lucid dreams came with the use of the eye movements to signal during REM sleep to code the occurrence of lucid dreaming. The discovery was developed almost simultaneously as part of two doctoral theses, one at Hull University in 1975 by Keith Hearne (Hearne & Melbourne, 1999) and the other at Stanford University in 1978 by Stephen LaBerge (LaBerge, 1985).

According to Hearne and Melbourne (1999) lucid dreams often start when the dreamer has noticed an anomaly within the dream which leads to lucidity through the dreamer questioning an "unreal" aspect of the dream experience. Indeed, Hearne and Melbourne recommend keeping a dream journal in order to learn to identify common elements of your dreams and to recognize dream signs when you are dreaming.

Even though lucid dreams are assumed to be a rare event, Gackenbach (1991) estimates of the frequency of having experienced at least one lucid dream, range from 47% to 100% of the population, depending on sample characteristics and how well the lucid dream concept has been explained to the sample. Gackenbach states that 13% of the dreams which are recalled on awakening and are recorded in dream diaries, are likely to be lucid.

One key factor in learning to have lucid dreams is, according to LaBerge and Rheingold (1990), the ability to have good dream recall. Motivation is thus said to be an important factor, indeed so much so that LaBerge and Rheingold write that in order for most people to succeed with this task, it is enough to have the intention to remember dreams and to be reminded of this intention before sleeping.

Following the establishment of good dream recall, there are several techniques that can be applied for inducing lucid dreams (Price, LaBerge, Bouchet, Ripert and Dane, 1991).

German psychologist Paul Tholey is one of the pioneers behind developing a novel technique for the induction of lucid dreams, known as *"the Reflection Technique"* (Tholey, 1989). The technique requires the participant to ask himself several times a day: "Am I awake, or am I dreaming?". The purpose of this is to activate and maintain the critical and reality monitoring functions of consciousness. LaBerge (1985) commenting on the apparent success of this technique, writes the more often we critically question our state of consciousness while awake, the more likely we will do so while dreaming. Tholey added the requirement to the technique that the question should be asked in daydreaming and dream-like situations in order to increase the possibility that the subject would recognize the dream state when it occurred.

A further development of this so-called "combined technique" adds elements of intention and autosuggestion (LaBerge & Rheingold, 1990). Examples of this are: telling yourself that tonight you will have a lucid dream, imagining what you would do if you were dreaming, and planning what you intend to do in your lucid dream. It is claimed that use of the technique enables individuals who have never experienced a lucid dream to reach a median of 4 to 5 lucid dreams per week.

An evaluation of Tholey's combined technique was reported by Zadra, Donderi, and Pihl (1992). They compared the effect of six weeks training with the technique using a group of lucid dreamers and non lucid dreamers. Both groups showed an possible effect but the technique was only significantly effective in the group which had had a previous experience of lucidity. LaBerge and Rheingold (1990) went on to further develop a modified version of the combined technique which they called the *"Reflection-Intention Technique"*. This contains four steps: 1. Plan when you intend to test your state; 2. Test your state; 3. Imagine yourself dreaming; 4. Imagine doing what you intend to do in your lucid dream.

Some caution seems appropriate here since, despite the claims for the effectiveness of these techniques, there is a distinct lack of well-conducted empirically based evaluations (Price et al. 1991). The reported evaluations tend to be based on small samples giving findings that are generally unclear. One exception is described by LaBerge and Levitan (1995) where three methods for inducing lucid dream were compared. The study which assessed the effect of MILD technique with 84 participants, did find an increase in the average number of lucid dreams per week from .21 to .37 while another technique (Reality testing) resulted in an increase in lucid dream weekly frequency from .21 to .53 (LaBerge & Levitan). However even in this case, data are lacking which would enable the statistical significance of this increase to be calculated.

Another lucid dream training program which has received some, albeit limited evaluation, is that developed by Harary and Weintraub (1999). This is a 30 day program aimed at inducing a high degree of lucidity and is partly based on principles derived from the dream Tibetan yogis. The programme contains elements of dream recall, state testing, autosuggestion, dream signs, etc. An evaluation of the effect of this training program on the recall frequency of lucid dream was reported by Bertelsen and Hjärtblom (2002). Their sample included 21 volunteers who followed the 30 day program. Lucid dream recall frequency was found to increase from a mean of = .33, (s = .55) dreams per week before the program started to a mean of.74, (s = 1.09) after the program terminated ($t = 2.086, p = .050$).

Amongst the techniques reviewed above, the *"Reflection-Intention Technique"* would not only appear to be the most comprehensive but also the latest one in the evolution of psychological methods for inducting lucid dreams. As is the case with its predecessors, this technique is also in need of empirical evaluation and it is for these reasons, that it became the method of choice for study being reported here.

Research Design

Based on the previous research reviewed above, the study was designed to evaluate the effects of a lucid dream training program based on the reflection-intention technique. In line with the findings presented earlier favouring a multi-method approach to dream recall, the design evaluated dream recall frequency via both a questionnaire and a personal dream journal.

The design for the study was a within-subjects using three repeated measures for dream and lucid dream recall frequency, corresponding to three treatment levels of the independent variable lucid dream training program (Mitchell & Jolley, 1996). The three treatment levels of the lucid dream training program were: 1) Before the commencement of the study 2) at the completion of the first week of the training program 3) and at the completion of the second week of the training program.

The *Dependent variables* included:

- Dream recall frequency (DRF). DRF which is defined here as the number of morning awakenings per week of seven nights in which there is dream recall. DRF was measured on the three evaluative occasions: before the training program (DRF0), during week one of the training program (DRF1), and during week two of the training program (DRF2).
- Lucid dream recall frequency (LDRF). LDRF which is defined here as the number of mornings per week in which with lucid dream recall is reported. LDRF is measured on three above mentioned evaluative occasions: before the training program (LDRF0), during week one of the training program (LDRF1), and during week two of the training program (LDRF2).

The two *major hypotheses* that were being tested in this study are that dream training program will significantly increase the general dream recall frequency (DFR), that is H_1: DRF2≥DRF1>DRF0, and that the dream training program will specifically increase lucid dream recall (LDRF), that is H_2: LDRF2≥LDRF1>LDRF0.

METHOD

Research participants

The participants for the study were recruited using email invitations describing the study and asking for interested volunteers. These were sent to colleagues of the first author who works as a consultant at Sigma Information Design AB, a consultant company working with customer product information and information management. The email invitation was sent to approximately 170 employees. The invitational letter briefly described the study and its context. The phenomenon lucid dream was explained along with the possible positive in order to encourage people to participate in the study. The purpose of the study was described as a two week study of a lucid dream training program carried out in collaboration with the second author at the Psychology Department at Gothenburg University where the project fulfilled part of the requirements for a Bachelor of Social Science.As a reward for completing the study, the participants received a lottery ticket.

The final sample included 31 participants (15 females and 16 males). Of these 11 participants, or 35%, did not complete the study. The age span of the participants that completed the study was 25-55. Average age was 35.2, standard deviation (s) = 7.6 years.

Instruments

All the instruments were in used their equivalent translated Swedish forms.

Introductory Questionnaire. The questionnaire asked for basic descriptive information about the participants and established a baseline for their existing frequency of dream recall. The questionnaire was self administered with forced choice answers and therefore was conveniently distributed via email. Important aspects of this questionnaire concerned a definition of a lucid dream, and a questions about the frequency of dream and lucid dream recall. This measure used a seven point raring scale (0 = never, 1 = less than once a month, 2 = about once a month, 3 = twice or three times a month, 4 = about once a week, 5 = several times a week and 6 = almost every morning) which had been used on several occasions by Schredl with a retest reliability $r = 0.83$ of an average interval of 70 days, (Schredl et al, 2003; Schredl & Hofmann, 2003). This scale measures the average DRF during the last months with the starting points defined as DRF0 and LDRF0 .

Other questions asked concerned number of hours slept per night, knowledge of the concept lucid dream and the highest degree of lucidity that the participant had previously reached (from 1 = Slight to 3 = Good lucidity with a definition of each degree).

Lucid Dream Training Program. The specific form of the lucid dream induction program used in this study was an adaptation of LaBerge and Rheingold's (1990) Reflection-Intention Technique which in itself is a modified version of Paul Tholey's Combined Technique. The program is based on critical state testing but also includes elements of intention and autosuggestion. The program used in the study had following instructions:

> "Every morning, plan when to check the state of mind during the day by selecting situations or scenes that are reminiscent of dreamlike experiences".
> "State testing should be performed a minimum of 5-10 times a day".

The program advised that the assessment of the state of mind during the day should be done by asking the question: "Am I dreaming or am I awake?". The program also recommended that before answering the question, that the participant critically examined the state of consciousness or so-called "mind state". The recommended circumstance for assessing the mind state, is (in accordance with LaBerge and Rheingold) "reading a text, looking away and then reading the text again" and then "If the text stays the same you are probably awake but if the text differs you are probably dreaming". Following the mind state assessment, the participant was asked to spend some time fantasising about what he should have done if he was dreaming in this specific situation, and concluding it with the suggestion: "Next time I am dreaming, I will remember to recognize that I am dreaming". The participant was also to picture what he would do if he was dreaming, for example flying, and try to imagine that feeling and once again remind himself to remember to recognize his dreams. Finally each night before falling asleep, the participant was instructed to express aloud: "Tonight I will have a lucid dream". The instructions in program also reminded the participant to fill in the dream journal each morning.

Dream Journal The dream journal is a formalised as a dream diary tabulating in the rows the types of data to be filled in with the columns representing each day/night period. The data collected included the number of hours slept, the total number of dreams recalled on awakening (including lucid dreams), the number of lucid dreams recalled on awakening, and the highest degree of lucidity obtained. It was important that the participant should record each morning whether or not he had followed the lucid dream training program the day before. There was also space for the participant to describe some of the dreams he/she had experienced and to give other comments.

Procedure

In order to make the study easy to administer and easy to participate for the participants, the use of online communication was chosen as the basis for the whole study. This meant that all the communication with the participants was done via e-mail. To make it clear for the participants, the study was described as containing four steps, as indicated below. Seen from an administrative point of view the study was conducted as follows:

An invitation email was sent to all potential participants and those volunteering received the introductory questionnaire along with an assurance of confidentiality. Following its return, the the lucid dream training program and the dream journal were sent to the participants. The e-mail, to which the documents were attached, contained instructions to follow the lucid dream training program for 14 days and to keep a dream journal for the same period. These instructions were repeated in the appropriate documents. The importance of filling in the dream journal directly on awakening was emphasised. Further emphasis was also placed on the importance of performing the training as much as possible.

During the 14 day test period, five reminder e-mails were sent out to the participants. These e-mails were simple reminders to follow the program but also allowed a participant to drop out of the study and be removed from the mailing list.

The concluding email announced the end of the study and requested the dream journal. The email also contained contact information for those who wanted to send the dream journal by mail post and offering the reimbursement of the costs.

An email containing links to web sites concerning lucid dreams and a selection of references to standard literature concerning lucid dreams was sent March 19. This email also included the last reminder to send in the concluding questionnaire and dream journal.

Drop out analysis. The 11 participants that didn't complete the study dropped out according to reasons given below: One person left the study March 8 due to illness without completing any part of the study and another left after completing the first stage giving lack of time as a reason. The nine individuals left for non-stated reasons either without completing any part or only the introductory questionnaires.

RESULTS

The completed Data was returned by a total of 20 of the 31 participants, 9 females and 11 males with an average age was 35.2, s = 7.6 years. 10 of the participants reported that they had heard about lucid dreams prior to the study and 13 of the participants (65%) reported having had a least one lucid dream (as defined to them in the instructions) before commencing the study. During the first week of the training program, 11 participants reported experiencing lucid dreaming and five of the eleven had never experienced a lucid dream before. Nine participants experienced lucid dreaming during the second week. Of the 13 subjects in total who reported having had a lucid dream prior to the study, 4 reported experiencing a high degree of lucidity.

Amongst the seven individuals who failed to report lucid dreams two week test period, five of them reported having had lucid dreams prior to the study, and the remaining two had not experienced lucid dreaming before the study (or during it).

The number of days the subjects performed the program on average during week 1 was 5.95, s = 1.39 and week 2 was 5.4, s = 2.19.

Dream recall frequency analysis.

As seen in table 1, the dream recall frequency mean increased from that occurring before the commencement of the study.

Table 1. Means and standard deviation for number of mornings per week with dream recall (DRF)

Variable	*Mean*	*Standard deviation*	*N*
DRF0 (before the study)	2.53	2.29	20
DRF1 (week 1)	4.75	1.65	20
DRF2 (week 2)	5.20	1.58	20

The outcome of a one-way repeated measures analysis of variance supported the hypothesis that the lucid dream training program would significantly increase the DRF ($F_{2,38} = 22.09$, $p<.05$) as seen in table 2. The effect size of the independent variable was $\eta_p^2 = .54$ and observed power = 1.00 (p=.05).

Table 2. Test of Within-Subject Effects for DRF

Source	*Type III Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*	η_p^2	*Observed Power*
Within subjects (treatments)	82.06	2	41.03	22.09	.000	.54	1.00
Error (residual)	70.57	38	1.86				

Mauchly's test of sphericity showed that the sphericity assumption was violated for DRF (W =.37, $p<.05$) but the F-value still proved to be significant ($p<.05$) using Greenhouse-Geisser (ἑ = .62), Hyunh-Feldt (ἑ =.64) and Lower bound correction factors (ἑ = .50) for *df*.

Post hoc tests were conducted by comparing pairs of means in order to identify where the differences were significant. The post hoc analysis was done using both Least Significant Difference (equal to no adjustments) and Bonferroni adjustment. With no adjustments the DRF increased significantly between before the study (DRF0) compared with week 1 and week 2, but also between week 1 and week 2. After using the Bonferroni correction, a significant difference could only be found between before the study and week 1 and 2. The difference in these results can be due to the Bonferroni analysis being more conservative, dividing p with number of t-test performed, in this case three. The results are presented in table 3.

Table 3. Multiple paired-sample t-tests for DRF

i	*j*	*Mean difference (i-j)*	*Std. error*	*Least Significant Difference Sig.*	*Bonferroni Sig.*
0	1	-2.23*	.50	.000	.001
0	2	-2.68*	.52	.000	.000
1	2	-.450	.20	.035	.105

* = The mean difference is significant at the .05 level with Bonferroni adjustment.

Lucid dream recall frequency analysis. The means and standard deviations for LDRF are presented in table 4.

Table 4. Means and standard deviations for number of mornings per week with lucid dream recall (LDRF)

Variable	*Mean*	*Standard deviation*	*N*
LDRF0 (before the study)	.13	.22	20
LDRF1 (week 1)	.90	1.02	20
LDRF2 (week 2)	1.25	1.86	20

As seen in the table 4, the lucid dream recall frequency mean increased from it value before the beginning of the study. A one-way repeated measures ANOVA supported the second major hypothesis, that the lucid dream training program would significantly increase the LDRF ($F_{2,38} = 5.96, p<.05$) as seen in table 5. The effect size of the independent variable was $\eta_p^2 = .24$ and observed power = .85 (p=.05).

Table 5. Test of Within-Subject Effects for LDRF

Source	*Type III Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*	η_p^2	*Observed Power*
Within subjects (treatments)	13.10	2	6.55	5.96	.006	.24	.85
Error (residual)	41.81	38	1.10				

Just as in the case of DRF, Mauchly's test of sphericity showed that the sphericity assumption was violated (W =.60, $p<.05$) but the F-value was still significant ($p<.05$) using Greenhouse-Geisser ($\acute{\varepsilon}$ = .71), Hyunh-Feldt ($\acute{\varepsilon}$ = .76) and Lower bound correction ($\acute{\varepsilon}$ = .50) factors for *df*.

The post-hoc analysis showed that the LDRF increased significantly between before the study compared with week 1 and week 2 as seen in table 6.

Table 6. Multiple paired-sample t-tests for LDRF

i	*j*	*Mean difference (i-j)*	*Std. error*	*Least Significant Difference Sig.*	*Bonferroni Sig.*
0	1	-.77*	.23	.004	.011
0	2	-1.12*	.42	.015	.044
1	2	-.350	.42	.015	.857

* = The mean difference is significant at the .05 level with Bonferroni adjustment.

The graphical representation shown below of the LDRF data shows that there were some possible outliers for LDRF2.

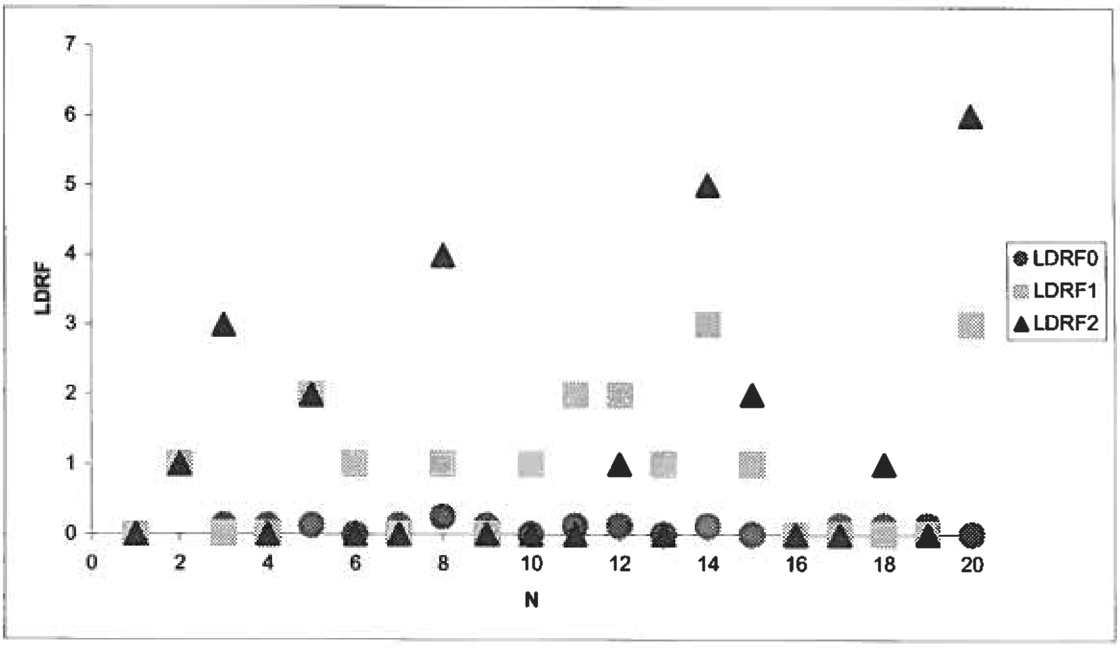

Figure 1. Graphical presentation of LDRF

Using Grubbs test for detecting outliers, the highest value, LDRF2 for the participant numbered 20, gave a corresponding Grubbs P-value of P = .10. Since this is larger than the chosen alpha level of .05 this means that the DRF2 value for participant 20 cannot be treated as a deviation. To be more confident of this finding, a new one-way repeated measures ANOVA was conducted without subject 20 with the result for LDRF was still significant, $F_{2,36} = 4.72, p<.05$.

DISCUSSION

The results showed a strong and significant DRF increase from before the program to week 1 and week 2 thereby supporting the first hypothesis concerning the efficacy of the technique. However in interpreting these results, an obvious limitation to the external validity of this study is the sample size (N = 20). A positive feature is that the study was conducted in home settings, not in a sleep laboratory, and therefore has reality import.

Another consideration is the possible effect of using two different measurement methods to assess dream recall: the questionnaire completed before the study and the dream journal completed during week 1 and week 2. According to Schredl (2002), earlier studies have shown the use of dream diaries will increase DRF compared with questionnaires, especially for low dream recallers. Such an effect might then explain the increased DRF and in fact the use of a dream journal could itself be seen as part of the independent variable being administered to the participants. On the other hand Schredl's own study and a later one (Schredl et al. 2003) failed to find evidence of such an increase in DRF during the use of a dream diary and this would argue against this being an explanation for the increase. Nevertheless, Schredl did find that the low and medium recallers were still affected by the use of a dream journal or diary so one could suspect that if the small sample in this study contained many low and medium recallers then this might still bias the result. In point of fact there were no low recallers in this study, only 12 medium recallers and 8 high recallers (according to Schredl definitions). This suggests that the use of dream journal cannot solely explain the increase of DRF. Moreover if the result from this study are compared with those results of Schredl, Schredl and Hoffmann (2003) and Schredl et al. as seen in table 9, it is obvious that the increase is quite large as compared to the earlier studies.

Table 7. Means and standard deviations for number of mornings per week with dream recall (DRF) compared with earlier studies (all measures converted to per week)

DRF scales	*Mean ± SD*
DRF questionnaire (per week) Schredl (2002)	2.31 ± 2.01
Dream diary (per week) Schredl (2002)	2.03 ± 1.37
DRF questionnaire (per week) Schredl and Hoffmann (2003)	2.06 ± .61
DRF scale, dream questionnaire (per week) Schredl et al. (2003)	2.80 ± 2.08
DRF scale, sleep questionnaire (per week) Schredl et al. (2003)	2.58 ± 2.03
Mornings with dream recall (per week) Schredl et al. (2003)	2.75 ± 3.69
Five point DRF scale SF-B (per week) Schredl et al. (2003)	3.21 ± 1.01
Dream diary (per week) Schredl et al. (2003)	3.38 ± 1.57
DRF0 (per week) this study	2.53 ± 2.29
DRF1 (per week) this study	4.75 ± 1.65
DRF2 (per week) this study	5.20 ± 1.58

The value for DRF0 (the baseline prior to the study) is within the range of the earlier studies (which did not include a lucid dream training program). It is however important to point out that the DRF used in this study includes the LDRF with the assumption being that the DRF referred to in earlier studies by Schredl also incorporates lucid dreams. (It seems unlikely that participants would fail to report a recall of a lucid dream as a form of dream recall.)

A further consideration concerns the self-selection bias in the study presumably favouring individuals particularly interested in sleep and dreams. In this respect it should be noted that the DRF0 mean is in fact comparable to those of other studies (as seen in table 9) and values for DRF1 and DRF2 are actually considerably higher than other DRF values including those from the studies using dream diary DRF. This suggests that the effect of using dream journals as a measurement method does not itself account for the increase.

If the effect is a genuine one relating to the training program, then what aspects of the program facilitated the increased DRF? It would seem safe to assume that by carrying through the lucid dream training program, the subjects were focusing their attention on dreaming and sleeping and according to Schredl (2002) this process in itself probably results in an increase of DRF. A conservative explanation is that dreams are not often recalled unless the sleeper awakens directly from the dream period rather than after the consecutive stages of sleep (LaBerge and Rheingold, 1990). It is however difficult to identify what components, if any, in the lucid dream training program could have which facilitate more awakenings in conjunction with dream periods. Despite the apparent success it should nevertheless be noted that the increase of DRF between week 1 and week 2 was not significant, indicating a possible ceiling effect.

The results for second hypothesis were also significant with a strong increase of LDRF from before the study to week 1 and week 2. The significant result indicates that the lucid dream training program did have an effect already during a short limited time of 1-2 weeks. This supports the statement made from LaBerge and Rheingold (1990) that many subjects using training programs such as Tholey's combined technique and MILD will experience lucid dreams very early on, even on the first night. Since we have no previous evaluative results for the combined technique to compare with, it is difficult to place the results into a wider perspective. The study referred to by LaBerge and Levitan (1995) had a baseline LDRF = .21 and a LDRF for MILD = .37 and a LDRF for reality testing = .53. In comparison the DRF0 of this study is lower (*LDRF0 = .13)* and LDRF1 and LDRF2 are much higher (*LDRF1 = .90, LDRF2 = 1.25*).

A discussion of internal validity raises the question: Was the increase of DRF and LDRF only an effect of the lucid dream training program or are there signs indicating that other variables could have influenced the results? The effect size (partial eta squared coefficient) for DRF ($\eta_p^2 = .54$) and LDRF ($\eta_p^2 = .24$) indicates that 54% of the total variance for DRF can be explained by variance of the independent variable. The effect size for LDRF ($\eta_p^2 = .24$) was smaller. Here only 24% of the total variance for LDRF can be attributed to the variance in the independent variable. Corresponding power values also confirm that the increase of DRF is stronger than the increase of LDRF. The observed power value for DRF was 1.00 (for the given alpha level of 5%, $p = .05$) meaning the probability for avoiding type II errors is very high (Mitchell & Jolley, 1996). For LDRF the observed power was .84, thus a slightly lower probability of avoiding type II errors.

Since we were using a repeated measures design, a further statistical consideration is whether the assumption of symmetry (that the variances within all conditions are equal) is justifiable (Field, 2000, Hassmén & Koivula, 1996; Girden, 1992). The absence of this entails a risk that each measurement will be correlated thereby rendering the critical F-values for repeated measure designs too low and increasing the risk for type I errors (Hassmén & Koivula, 1996). A test of this key assumption is Mauchly's test of sphericity (Girden, 1992). Sphericity is a form of compound symmetry (Field, 2000; Girden, 1992). If Mauchly's test is significant, then the assumption is violated and the F-value should be corrected. The correction is made by using a correction factor ($\acute{\varepsilon}$) on the degrees of freedom (Hassmén & Koivula). In this case as concerns both DRF and LDRF the assumption was indeed violated. However when three different correction factors were applied, the results still stayed statistically significant. [2]

Although a claim has been made for the Tholey combined technique having produced lucid dreams in non-lucid dreamers during a median period of 4 to 5 weeks (Tholey quoted in LaBerge and Rheingold 1990), the present study even excels even this. Of the seven participants who had not experienced lucid dreaming before the study, five experienced lucid dreaming during this two week study, and all five achieved this during the first week. The results here can favourably be compared with those of Bertelsen and Hjärtblom's (2002), which used the Harvey and Weintraub's 30 days program.

A limitation to the construct validity of the study concerns the demand characteristics (Mitchell & Jolley, 1996) in terms of the positive expectancy implicit in getting participants to carry through a lucid dream training program. A possible vacuum for such a bias to operate in is the – at times – rather arbitrary interpretation of what constitutes a dream. Fragmented memory images and feelings may be elaborated on in the waking state and labelled a dream or several dreams. From this point of view the recall of lucid dreams with their distinctive features may be a more reliable aspect.

It is with this respect to an aim of seeing what may have been happening in the study, that the qualitative reports of participants can be illuminating. Examples of the difficulty of

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[2] A further caveat, according to Karpinski (2004), would be that the violation was so severe that it is not possible to correct the F-test. As a rule of thumb, Karpinski states that the presence of a Greenhouse-Geisser correction factor $\acute{\varepsilon} < .7$ would indicate a multivariate ANOVA (MANOVA) could be used instead. In this study, the corresponding correlation factors for Greenhouse-Geisser (DRF $\acute{\varepsilon} = .62$, LDRF $\acute{\varepsilon} = .71$) were below and slightly above this limit indicating that MANOVA could or should be conducted instead. However, a more common alternative is to correct degrees of freedom since MANOVA is less powerful than ANOVA (Karpinski). Hassmén and Koivula mention MANOVA as an interesting alternative to ANOVA, but do not identify it as mandatory when the sphericity assumption is violated.

identifying what a dream are not difficult to find. One participant wrote for one night: "I do not recognize any dream with pictures but I do remember dreaming about hearing voices". Another dreamer wrote that when she was realising that she was dreaming, she felt like she could not grasp it, the dream existed around her but it felt as an object, from which she felt "separated". One recaller stated that she often recalls details of the dreams but not the whole dream plot. False attribution of states could also occur such as a dreamer who dreamt she was losing teeth, and she discussed this with her dentist who proclaimed "these things happen in dreams" and she answered "but I am not dreaming". Interestingly, one subject noted that "now that I know what lucid dreams are, I have had more than I registered in the first questionnaire". "This was a cool study!". The most committed participant wrote a comprehensive five page dream diary which was attached to the dream journal. There were also many interesting examples of "day residue", of continuity between waking content and dream content, and of that dreams that were very incoherent. One subject also stated that every time she performed the state test during dreaming she awoke. Several subjects also stated that they intended to continue the program after the study since it had yielded interesting results, which is a good sign of the value of the program.

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