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## The Impact of Cognitive Psychology in Minimizing Human Errors

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## The impact of cognitive psychology in minimizing human errors

### Abstract

Working towards zero accidents – Experience from education and supervision of pilots and air traffic controllers (ATC) from the Royal Danish Air Force gives us a model on how to apply the latest clinical psychology methods and research, and combine it with Human Factor models.

What is behind accidents? Errors, so can you talk about zero errors? Everyone knows that this is utopia; the question is rather how we can understand errors, minimize errors and minimize the effect of errors. The goal of this paper is to contribute to a theoretical and practical understanding of how to use the research results of clinical psychology methods, hence the elements that you can transfer to a teaching situation to provide tools to be able to handle errors. In light of research findings from the clinical cognitive behavioral psychology, it is pertinent to examine the transfer values for teaching pilots and ATC. The following methods, concepts and materials have been used:

- Cognitive model of the mind
- Acceptance
- Focusing mentally and Visualization
- Reformulation

The clinical research findings presented in the paper is based on a literature review. Results in relation to transfer values presented in this paper are based on written and oral evaluation from the pilots and ATC after teaching. Therefore, the scaling results cannot be understood as evidence-based, instead, it is seen as an indication of how strategies from clinical psychology can be used in education of pilots/ATC to influence the self-perception and hereby reduce the amount and the impact of errors for the participants. Therefore, the paper can be used as an inspiration to practical use and further research.

### Introduction

Before I started working in the area of Aviation Psychology I used several different treatment methods working as a clinical psychologist. Therefore, I have been very interested in the evidence of treatment methods. The idea to look into a transformation of methods from the world of clinical psychology treatment to the world of Aviation Psychology, emerged when I was teaching a course in psychology to pilot trainees within the Danish Defense. During the course, it became clear that some of the students feared making mistakes during flights, and they wanted to discuss how they could prevent errors. My interest to see how strategies from clinical treatment methods could be converted into teaching situations with the focus of how to handle mistakes and errors grew from these discussions. Now, the teaching has developed to not only relate to pilot students but also to students within Air Traffic Controlling (ATC), pilots and ATC's in various courses of continuing training (including in their CRM/TRM, instructor- and aviation safety training courses).

The reason I identified the relationship between clinical treatment and minimizing human errors was the basic element of psychology in both subjects. An essential part of clinical therapy is giving the client an understanding of the perception he has of himself as well as of the surrounding world, and furthermore making the client see how he can think or understand himself in different ways. The underlying idea of this education is to provide the client the strategies to take action, obtain a better capability to understand himself and his surroundings, and therefore also the possibility to change his reactions, e.g. in situations that may occur during a flight. It is especially this connection between treatment and education that makes it extremely interesting and relevant to develop and explore the effects of using methods from clinical therapy in Aviation Psychology.

### Evidence-based treatment

There is a long tradition within therapy to study the evidence of the treatments. In 1999 Hubble, et al. published a meta-analysis based on the last 40 years of research and they summarized what worked in therapy. The results identified some general factors or basic elements which should be in place in the treatment to obtain a positive result, meaning the client would get better after therapy. Hubble et al. concluded that four general elements were present, (1) Extratherapeutic Factors (the client factor) which accounted for 40% (2) the Relationship Factor that accounted for 30%, (3) the Hope and Expectations Factor which accounted for 15% and (4) the Model and Technology Factor that accounted for 15%.

Extratherapeutic Factors include the client's personality, intellectual level, motivation, mental strengths and weaknesses, values, resources, potential, experience, etc. The second largest factor, the Relational Factor, is based on the client's perception of the therapist and includes understanding, acceptance, warmth, authenticity, etc. The Hope and Expectations Factor represent the client's expectations and the hopes of the possibility of development and improvement of the therapy. The last factor, the Model and Technology Factor (described below), includes the theoretical background a therapist is working with in therapy.

The focus is on the client's resources and how the person wants to experience the therapy. Does this mean that the therapist cannot affect the process? No. As described by Morawetz in *"What works in therapy? What Australian Clients Say"* the therapist has many opportunities to improve and strengthen client opinion through various strategies. This can be done in different ways, for example (1) by the therapist assessing the client's strengths and resources (2) asking the client to describe the problem and ask what solutions the client sees (3) by having the therapist focus on present and future solutions instead of past problems the client has had, or (4) by choosing a treatment appropriate for the client and (5) the therapist being genuine and accepting during treatment. Therefore, all in all, one can say that the most important thing is for the therapist to meet the client where the client is.

When examining the Model and Technology Factor, what kind of results do we see? Cognitive Behavioral Therapy (CBT) is one of the most studied and evaluated approaches within therapy. Butler et al. states in their article, that between 1986 and 1993 120 studies had been conducted and now 325 studies on the effect of CBT effect have been published. One possible explanation for the high number of studies stated by Butler et al. is, relates to the positive results of this method of therapy regarding depression (this form of therapy started out for people suffering a depression) and hence researchers want to see if CBT can be transferred to other areas. Later research has shown that CBT therapy also is highly effective in treating general anxiety, panic, social phobia and PTSD, and positive tendencies have been identified in many other areas (p. 17-31).

### **The relationship between evidence-based treatment and education#**

What kind of parallels can be drawn when transferring evidence-based treatment into education for pilots and ATC? King describes in the chapter "Teaching" in the book "Aerospace Clinical Psychology" dimensions a teacher should considerate and should draw attention to when teaching pilots. The following are some examples from King's book regarding these elements: *"Above all else: know your audience! Prepare so that you appear spontaneous, know what you're talking about, use aviation metaphors, be funny"* (p.47-52). The parallels to Morawetz strategies of how to improve the relationship between client and therapist are clear, thereby, what is important for a positive outcome in treatment is therefore also important in teaching.

Of course, there are differences between teaching and therapy, but I believe that in both areas we see some basic elements or general factors that whether you are a therapist or a teacher are relevant to getting your message through to your audience. Hence, one must pay attention to those general factors and what tools you possess as a teacher to get your students attention. Given we have the students' attention and interest in place, we know that a large part of the teaching of pilots and ATC within Human Factors and CRM/TRM, is partly based on experiences, events, theories of human-machine interfaces, human-human interaction, basic theories within psychology and so on. Therefore, it is also important to look at how the understanding within psychology has developed during the last few years and hence also the forms of therapy, and how and what will be meaningful to transform to our target audience.

Free describes in his book *"Cognitive Therapy in Groups"* that he consider the CBT Group Therapy as a "psycho-education-group" or an "evening class on cookery" in which the focus is on teaching the clients new strategies for action (p. 40-41). How Free defines the CBT group, is of course also what you want in teaching, to provide students with knowledge and making them able to use this knowledge. The cognitive approach aims to give the client the tools to become their own "therapist", which is relates well to the aim of teaching. The connection between CBT and efforts to minimize human errors is that by becoming your own "therapist" or "teacher", you will acquire both a new understanding as well as the tools to be able to react differently to your perception of a particular situation and hence avoid, minimize or stop a sequence of errors.

## Cognitive therapy's theory

Cognitive therapy was developed by Aaron T. Beck. The basic understanding of the cognitive therapy is that the client in collaboration with the therapist explores the client's perception of herself and the outside world. Symptoms of the client's condition can be expressed through cognitive, emotional, physiological or behavioral responses. The symptoms reflect the perception the client has of herself, especially underlying assumptions expressed by the client that reflect automatically activated negative thoughts, often without the client being aware of this. The negative automatic thoughts, based in the client's underlying assumptions about herself, results in the individual's personal schedules, ie. her own understanding of herself. The cognitive theory suggests that the individual has some early learning and experiences that have led to the development of some dysfunctional schemes of the self and the surrounding world, but there are often some critical events that trigger development a mental illness.

One cognitive model, by some named the Cognitive Diamond, looks at the individual's thoughts, emotions, body, behavior and the relationship between these elements. The thoughts a person can have in a given situation can lead to a feeling and/or a physical reaction which can result in more negative automatic thoughts and so on. In other words it becomes self-reinforcing. An example: During a debriefing, a student pilot is informed by his instructor, that he made an error during a flight. Depending on the student's self-perception and his past experiences, this situation can evolve in many different ways. If the student does not understand what he did incorrect, but does not dare to ask (passive behavior), maybe because the student thinks "I am also too stupid to understand" (thought) which results in uncertainty and anxiety (feeling). When a person experiences this, the body reacts with heart banking and sweating (body), which in turn leads to the idea that he will never become a pilot (thought). The learning attained by the student is about the student's personal schedules confirming that he is incompetent. The result is that the education regarding the error fails, and as a side effect, but an important one, the instructor believes that the student has understood the education and embraced it. When the student makes the error again the instructor becomes irritated (feeling) and thinks "this student cannot learn this, it is going too slow, he will never become a pilot" (thought). The instructor begins to look for errors regarding the student (perception) which in turn confirms the instructor's opinion, and ultimately it becomes self-validating for both the student and the instructor.



Figure 1. The cognitive diamond.

The cognitive model's understanding of thoughts includes the individual's values, rules of life, opinions, beliefs and motives. Regarding feelings, the model includes the six basic states of the human mood: happiness, sadness, anger, anxiety, astonishment and disgust. Regarding body, the model includes the energy level and the stress level, and regarding the last of the four dimensions, the behavior, the model includes skills (what you can do) and the habit (what you actually do). When dealing with the situation, the thoughts, the feelings, the body reactions, the behavior and the consequences of it all, you are looking into the past and present. To find solutions, we must also look at the need for change, ie. look at the person's goals and resources to achieve the desired result. Hence, you look at the present and the future, which is also highlighted by Morawetz as an important element, which allows the therapist to influence the relationship. The background for this paragraph is taken from Judith Beck's book "Cognitive Therapy" and Irene Oestrich's book "Tankens kraft".

## Practical use of CBT in teaching how to minimize Human Errors

Within the CBT treatment, the structure is essential, both in the session but also throughout the therapy, e.g. the first therapy session will focus on a review of the client's problem, the client's desires, CBT's way of working and so on. This is exactly the same as when planning a teaching session and parallels are clear. For example, if we look at the structuring of CRM/TRM lessons or the construction of King's "Twelve-Step Lesson Plan" (p.48-52). Generally, the CBT has three essential pillars (1) education process, (2) self-monitoring, (3) exploring and testing. It is important to understand that this not a static process, but in the treatment you oscillate between all three pillars. In this process, there is also a constantly reconciliation, discussion and following up on the target. When you are teaching pilots and ATC, it is essential that you as a teacher at all times are aware of and constantly draw parallels to their reality, as King highlights (p.47-52), that means transferring a general understanding of how humans function into a situation relevant for pilots and/or ATC, and furthermore include the understanding of how, when registering that we are making an error, this will be expressed and what signals we receive from ourselves before or while making the error. A great advantage in teaching or in group therapy is the ability to use the group dynamic regarding the way of thinking and thereby create reflections inside every single individual.

One of the main pillars of the CBT structure is psycho-education. The personnel, who have had no previous education within this subject, will first receive a presentation of the cognitive thought, in this the Cognitive Diamond and how thoughts, feelings, body and behavior are linked together. The presentation will be followed by an exercise where the students are given approximately 30 different statements. The students are instructed to determine whether the statements are thoughts, feelings, body expressions or behavior (exploring and testing). Afterwards all statements are discussed one after one, increasing their understanding of the concept and theory. The next step a presentation of the relevance of how to understand themselves and the world surrounding them, the influence of negative thoughts, but also that a thought is just a thought. A thought might be right, it might be wrong, but you can test thoughts, and thoughts can change. Next step is an exercise (described in the next section), in which the students fill out diagrams describing how they react. This last part is the first step of providing the students tools to self-monitoring. During this process they are introduced to the chain analysis, which is a method to understand and modify unwanted incidents. This provides the students a concrete and practical method to monitor themselves and test their thoughts and eventually discover alternative strategies.

An important process to make students aware of when they need to obtain a new behavior is the educational process. This process consists of different steps and the students should be aware of what they must pay attention to in the steps. When talking to students, it seems that they are giving too much attention to the phase of flight/live traffic control (ATC) and almost forget what they need to work on between sessions. Figure two is shown to the students while teaching. The session step indicates the time of flying or being in a live traffic situation. When teaching, each phase is examined separately and psycho-educating is done on what to be aware of, followed by discussion and transfer of the knowledge into relevant situations, e.g. a discussion of how to maximize the gain of an instructor during a debriefing. In this phase, focus is on questioning techniques, in-depth questions that lead to greater understanding, but also on making the students aware of and focus on their own reaction in relation to the information that they receive from the instructor, again to increase the awareness of their own reactions. Next phase is reflection and analysis. In teaching, we show two different shooting boards (see figure 3), and ask which one they would wish they had done. Every time, almost everyone say the right one. Then the points attained from shooting are shown, the left receives 88 points and the right 61 points. The instructor informs that students have lost the game, and quickly the discussion sets off with the argument that the right shooting board is easier to correct, e.g. sight is not set correctly. In this phase, focus is on getting a discussion of whether there is a pattern versus a coincidence, how to find out when to be extra vigilant, identify alternative behavior patterns and thoughts. In other words, learn to reflect after a debriefing and how to analyze what needs to be developed before the next session. Based on the results of the analysis, next phase is to work on the desired behavior. It may be that the students need to understand more theory, practice in a simulator, have mental training, do visualization exercises and step for step training. The last phase before the new session is briefing, focusing on expectations and what they must focus on, what they discussed in the last debriefing, etc.

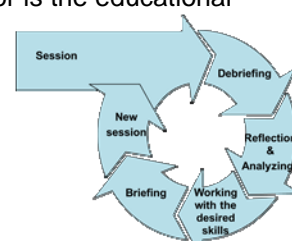


Figure 2. The process between the flights/live traffic for ATC.

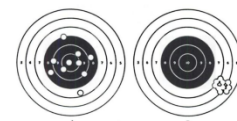


Figure 3.

As described, a large part of the cognitive understanding is related to how you think and if the result of the way the person thinks is destructive, it is important to find alternative ways to think about it, that is, to reformulate your thoughts. An example, when ATC identify a conflict on the radar screen (the stress level is high), accidentally they will tell the pilot to climb to a new level, even though this creates a new conflict. What's interesting, is that the ATC usually already has observed the conflict and is aware of it, and yet he still tells the pilot to climb to the new level and create a new conflict. From a neurological theory called the Serial Position Effect, we know that people often remember the first and the last thing, in other words, it is what's in between you forget (Gade, p 218). When asking ATC's how they think in situations like this, many describe that they scan the radar screen, that they often prior to the incident have had a conflict, and when observing the new situation they think "I must not say, climb to flight level 300". Due to the rapid change of situation, they end up doing the exact opposite and tell the flight "climb to flight level 300" creating a conflict. Instead, the focus should be on the desired outcome, thus to think of what to do, e.g. telling the flight to climb to flight level 280. Attention should be on what to do and not on what to avoid. When you are working to change a behavior, it is important to make students aware of when and how to train the new behavior.

As I described in the introduction it happens that students freeze when they make a mistake (often a perfectionist personality) and the error comes to rummage in such a degree that they do not react or act on

the error affecting the rest of the flight. A classic statement is that "an error leads to another error", so the importance of breaking the pattern is extremely high. It may also be that the student keeps thinking about *not* making mistakes, leading to actually making mistakes. In this situation you can work both long-term on the student's personality and/or focusing on the situation here and now. This may require supervision of the instructors on how to manage the student and sometimes coaching of the student herself. In teaching, we usually discuss what our experience tells us, that everyone makes mistakes and that it is normal to be annoyed when you make a mistake (normalization), but also to learn from their mistakes and that's it is on the flying school they can make mistakes while they have an instructor at their side. In the discussion all agree that it is unsuitable to have an over-reliance on errors during the flight. This is exemplified by an exercise among the students – the instruction is: "*You may not think about what I say - a pink elephant*". What happens – well, you think about a pink elephant. This is where the theory and understanding of the term acceptance enters. Simplified, the idea is, the faster you accept it, the faster you find a solution and therefore the faster you can move forward.

### Example of an Exercise

One of the exercises used in teaching is to give students an understanding of how thought, emotion, body and behavior works. The exercise is used relatively early in the process to give them a practical understanding of the model. Additional reason for this exercise is to give students the awareness that they might react differently to the same situation occurring several times, even though it is in fact the same situation, additionally how the reaction is different.

The first step is to gather the group in a circle, the students receives a balloon – often laughter and curiosity about what will happen arises already, being a positive sign, that you have their attention. This is a clear parallel to both Huddle and King's descriptions of what is important in attaining a positive result. The instructions follow to inflate the balloon, tie it and hold it between your hands at stomach height and close your eyes. They cannot open their eyes or say anything, until the instructor lets them. The situation changed rapidly from laughter to silence and a certain amount of tension. The instructor chooses a balloon and blasts it with a needle. The first reaction of the students is often a pair of open eyes, a few laughs, a few tense facial expressions, and others states afterwards that they started listening more carefully when the instructor entered the circle. The students are now asked to take their seats again and are handed a scheme to write down their experiences regarding the situation, the thoughts they had regarding of the situation, their emotions and how strong these emotions were on a scale of one to ten, and how their body responded when the balloon bursted. When everyone is finished filling out the scheme the instructor ask how they experienced filling out the scheme, if there were anything they were uncertain of, etc. Afterwards, the students are again asked to gather in a circle and the exercise is repeated including the filling of evaluations schemes. The instructor observes the group and notes in his memory differences in group behavior between the first and the second sequence.

The next step is discussion; the instructor starts by asking if someone wants to tell what she wrote, both the first and the second time. The instructor goes through a couple of experiences, and focuses on the differences, how they were expressed, whether they tried to have a strategy in the second sequence, if it was easier to fill in the scheme second time, etc. The last step is to transform the exercise to "reality", in other words working on transferring the experiences to their reality and discussing what this exercise reflects, what can be transferred to the flight deck, how it can be understood in relation to errors, how can we use it, what their answers reflect, what they should work on and so on.

Generally you often see the reactions dividing into three groups, one group expressing that they knew what would happen the second time and therefore were not that uncertain, the second group expressing that they do not experience the big difference between the two sequences and the last group expressing that they became more nervous the second time, because now they knew what would happen and they were certain their balloon would be picked. The instructor relates every reaction to making errors and what it would mean in "real life" with these kinds of reaction patterns, and what to work with in every reaction pattern. Experience shows that it is the latter group that needs to work the hardest to manage and develop a more constructive way to pass the education but also to respond to the errors they make.

The experiences with this exercise are very positive. This exercise (exploring and testing) gives the students tools and a scheme to learning how to register their own reactions (self-monitoring). Furthermore, the

strength is related to providing an understanding of how a perception can be changed even though it is the same basic situation.

### Evaluation of the implementation of cognitive therapy methods in teaching

Three different groups of personnel have been subject of the evaluation of the education of cognitive psychology; these groups are ATC students, students from the Royal Danish Air Force Flying School and employees within the Royal Danish Air Force (RDAF). All courses within cognitive psychology in the RDAF have been evaluated. Therefore, the results at hand will provide insight into the relevance of cognitive psychology in all relevant functions within the Air Force, both from a student point of view as well from current employees within the RDAF, from Pilots and Air Traffic Controllers to Technical Personnel and Mission Planner.

Timing of the cognitive psychology course has been planned according to the elements and flow of the overall education of the students and the employees. From this viewpoint a 3 day course was planned just prior to startup of On Job Training for the ATC students providing them instruments relevant when turning to the more “real” part of the education. At the Royal Danish Flying School the training within cognitive psychology was planned as a separate course and for the employees within the RDAF the course was implemented as part of continuing education. The training material focused on the same issues within cognitive psychology, but was of course targeted to the various groups making the education as targeted and relevant as possible.

Immediately after completion of the course, participants evaluated its utilization, keeping the evaluation up to date and making sure it would reflect the actual experience of the course. Furthermore, the evaluation process was separated from the education, securing unbiased results as the teacher had no part in the evaluation process. Evaluation was either conducted as an online survey or by using handout evaluation schemes.

Education within the field of cognitive psychology was initiated in 2009, however, it was not until 2010 an organized evaluation of education was put in place. This paper includes all evaluation since 2010.

All questionnaires used for the evaluation was divided into two parts. The first part of the questionnaire included scales providing quantitative measures of the assessment of the course. The scales covered academic content, relevance as well as skills of the educator. The second part provided an opportunity to deepen the evaluation with personal comments.

### Results

The evaluation of the cognitive psychology course included dimensions related to the fundamental elements of the cognitive psychology and of course evaluation of the perceived professional gain from attending the course. The results are divided into the three different groups of personnel.

Looking across all results it is evident that the education pays off. All three groups of personnel assess the education very positively. Looking at the results among students, table 1 and 2, all ATC students find the course professionally relevant; Furthermore, 10 out of 11 students have a positive assessment of the professional gain from the course. Likewise, the ranks from the students of the Royal Danish Flying School all range from ‘Good’ to ‘Excellent’. Especially, the evaluated Professional Relevance and Professional Gain are of particular interest when evaluating the eligibility of the course. Both dimensions rank high underlining the appraisal of the elements of cognitive psychology implemented during training.

Psychological Factors in Aviation - ATC students			
Assessment of following dimensions (share):			
	:(	:-	:-)
Overall assesment/ Professional Gain	0%	9%	91%
	Not relevant		Relevant
Professional Relevance	0%		100%

Human Factors, Psychological Factors In Aviation - RDAF Flying School							
2012							
Assessment of following dimensions (share):	1: Very Poor	2: Poor	3: Good	4: Very Good	5: Excellent	Very good & Excellent - Share	Mean
Professional Relevance	0%	0%	44%	33%	22%	56%	3,8
Overall assesment/ professional Gain	0%	0%	44%	33%	22%	56%	3,8
Teachers Academic Level	0%	0%	44%	22%	33%	56%	3,9
Teachers Motivation	0%	0%	44%	44%	11%	56%	3,7
Teachers Presentation	0%	0%	56%	33%	11%	44%	3,6
Relevance of Teaching Me	0%	0%	78%	11%	11%	22%	3,3
Teaching Materials	0%	0%	44%	33%	22%	56%	3,8

In table 3 we have the employees within the RDAF, where the course was implemented as part of continuing education. Even here the assessment shows the strong relevance of cognitive psychology. In 2010 the Professional Relevance was evaluated extremely well with more than 3 out of 4 ranking it ‘Very good’ or

even 'Excellent'. In 2012 the evaluation decreased a bit with half the participants ranking it 'Very good' or 'Excellent'. However, we must keep in mind that is still a very strong assessment. Furthermore in 2012 the group of participants was much more diversified than the previous two years, making it more difficult to embrace all functions equally well.

Looking further into these results we see that the part of the course showing the most positive increase are the dimensions related to planning and organization. From the 2010 results it became clear that the participants needed more time devoted to cognitive psychology in order to get the full value of the principles. And since the relevance and gain from the course was very satisfying, the decision was made to increase the number of lessons. Today, the number of hours has doubled compared to 2010.

To sum up, the results clearly indicates the relevance of cognitive psychology within aviation. However, though all participants have evaluated the course, we need to keep in mind that the number of evaluations are still limited and should be assessed from a qualitative point of view.

Human Factors, Psychological Factors in Aviation - EMPLOYEES - MEANS			
Assessment of following dimensions (share):	2010	2011	2012
Professional Relevance	3,9	3,9	3,6
Professional Gain	3,7	3,5	3,7
Teachers Presentation	3,7	4,0	4,0
Teachers Academic Level	3,9	3,9	4,0
Teaching Materials	2,9	3,4	3,3
Assessment of following dimensions (share):	2010	2011	2012
Academic Level	3,4	3,4	3,3
Time in relation to Curriculum	2,2	3,0	2,9

Human Factors, Psychological Factors in Aviation - EMPLOYEES						
2010						
Assessment of following dimensions (share):	1: Very Poor	2: Poor	3: Good	4: Very Good	5: Excellent	Share of 'Very good' & 'Excellent'
Professional Relevance	0%	0%	22%	61%	17%	78%
Professional Gain	0%	6%	33%	50%	11%	61%
Teachers Presentation	0%	0%	44%	44%	11%	56%
Teachers Academic Level	0%	0%	22%	61%	17%	78%
Teaching Materials	0%	11%	67%	17%	0%	17%
Assessment of following dimensions (share):	1: Not at all adequate	2: Not adequate	3: Adequate	4: Not adequate	5: Not at all adequate	Share of 'Adequate'
Academic Level	0%	0%	56%	44%	0%	56%
Time in relation to Curriculum	17%	50%	33%	0%	0%	33%
2011						
Assessment of following dimensions (share):	1: Very Poor	2: Poor	3: Good	4: Very Good	5: Excellent	Share of 'Very good' & 'Excellent'
Professional Relevance	0%	0%	26%	61%	13%	74%
Professional Gain	0%	0%	57%	39%	4%	43%
Teachers Presentation	0%	4%	22%	43%	30%	74%
Teachers Academic Level	0%	0%	22%	65%	13%	78%
Teaching Materials	0%	0%	64%	36%	0%	36%
Assessment of following dimensions (share):	1: Very Poor	2: Poor	3: Good	4: Very Good	5: Excellent	Share of 'Adequate'
Academic Level	0%	0%	57%	43%	0%	57%
Time in relation to Curriculum	0%	4%	96%	0%	0%	96%
2012						
Assessment of following dimensions (share):	1: Very Poor	2: Poor	3: Good	4: Very Good	5: Excellent	Share of 'Very good' & 'Excellent'
Professional Relevance	0%	0%	50%	41%	9%	50%
Professional Gain	0%	0%	45%	36%	18%	55%
Teachers Presentation	0%	0%	18%	64%	18%	82%
Teachers Academic Level	0%	0%	27%	50%	23%	73%
Teaching Materials	0%	0%	82%	9%	9%	18%
Assessment of following dimensions (share):	1: Very Poor	2: Poor	3: Good	4: Very Good	5: Excellent	Share of 'Adequate'
Academic Level	0%	0%	73%	27%	0%	73%
Time in relation to Curriculum	0%	9%	91%	0%	0%	91%

## Discussion

In this article, I have presented the views of both Hubble and King regarding factors that must be in place in therapy and education to achieve a positive result. In the evaluation schemes this can be expressed as the academic level of the teacher, his motivation and his presentation skills. All in all, 71% states that the academic level was 'Very Good'/'Excellent'. Similar results are seen regarding presentation skills (64%) and motivation (56%). No one evaluated the dimensions less than 'Good'. Hence, one can conclude that teaching has met the expectations and generated interest.

It has not been possible to determine whether the education alone has lead to lesser errors or to detecting errors faster. This is due to terms of resources and the research aspects. A general problem is how to study evidence that the education actually has a positive outcome in relation to minimize errors. Instead we can turn to look at the evaluation of teaching and what people think about the relevance and gain from it. All in all, 71% states that the education is 'Very Good'/'Excellent' in relation to relevance, and the gain from attending the course is likewise by 61% stated to be 'Very Good'/'Excellent'. Almost no one evaluated the dimensions less than 'Good' (except for one person in gain). Furthermore, verbatims from the students underline these results, providing clear signals that the cognitive theory is relevant to this audience. These are some of the verbatims from the students: "It was great getting "tools" from the psychologist that I can use in my work every day.", "A lot of useful hints and tools", "Wonderful with tools that you can bring home with you and use, and that we have the opportunity to test and train the methods while help is at hand", "A lot of things have been examined, and if things are done like this, I'm sure, it would make everyday life a whole lot easier. I think that we all take a small part of it home, and are excited to see results."



## Perspective and Conclusion#

Results from the evidence-based research identifies some general factors that should be in place for a positive outcome of treatment. The teaching should certainly include these general factors to ensure contact, motivation and the good relationship between the teacher and the students. Education is of course also about learning why it is not enough to just look at general factors, but it is important to look at the evidence-based research within the different treatment methods. The treatment that is mostly emphasized at the moment is the cognitive behavioral therapy. In the article, I have shown the underlying theory and the practical transfer to education for pilots and ATC area in relation to how they understand themselves, by learning the cognitive understanding through the education process, self-monitoring and exploring/testing. The idea is that by increasing understanding you can avoid/reduce/manage errors. As revealed in the result and discussion part, clear indications are given that the education is relevant and with a large gain. With that said, it is important to remember that the article and the evaluation results should be seen as an indication and inspiration to practical use and future follow-up studies and research.

In this article, the focus has been on the cognitive therapy's role in teaching. There are indications of acceptance and visualization techniques received positively by the students, but in the evaluation the focus has been on the overall education. It would be interesting to examine more specifically the concepts or elements of learning to look at the effect. A concept that I think should be explored further in relation to Error Management is the term 'accepting'. In therapy we know that the concept is very important, because, the faster a person can accept an idea or a situation, the faster will he find the solution to the problem and move on. Hence, it would be the interesting if it can be transferred to a cockpit situation, in other words if focus will be aimed faster on solution? CBT has been transferred to many other therapeutic areas, and it can be concluded from these results, that it is also possible successfully transfer CBT to education of pilots and ATC.

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