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Aviation Psychology: Optimizing Human Behaviors For The Excellence In Aviation

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Abstract: Aviation psychology is a study for optimizing human behavior and emotion in the field of aviation. Its aim is understand and improving human performance in aviation, air traffic controllers and ground support personnel. Aviation psychology deals with the operator's basic limitations and needs. For the excellence in performance, adequate training on human machine interference and equipment are required. The result is mainly focused on improving efficiency, safety of work in aviation and promoting smooth operation. It creates a balance between automation and employers in the field of aviation. Aviation psychology is a valuable tool for the assessment of employers and their coordination. Aviation psychologists promise that different personalities harmonize bringing economical benefits and job satisfaction.

I. INTRODUCTION

Aeronautical decision making is defined by the FAA as a "symmetric approach to the mental process used by aircraft pilots to consistently determine the best course of action in response to a given set of circumstances". Decision making is a complex task which is affected by situational and technical environment. The study is done on improving casual decision errors, hence reducing unsafe acts and skilled based errors.

Aviation Psychology is useful in identifying the potential hazards in the work environment and unified effort to increase safety and risk management. The acceptance of aviation psychology will provide growth in aviation industry because human error can be damaging in high risk environment which results in tragic loss of life and significant loss.

II. NEED FOR AVIATION PSYCOLOGY

A. Areas of inquiry where aviation psychologist are engaged

1. Error management
   Work on crew coordination and error management and develop instruments method through technical training.
2. Decision making and high stress situation
   Examine pilot decision making and judgment and factors that affect pilot performance in stressful situation such as passenger evacuating on airplane under an emergency situation.
3. Automation and human machine interface
   Development methods in aircraft system status display, vertical and horizontal navigation displays, aircraft situation awareness displays.
4. Accident reduction
   Identify factors common to multiple accidents. Strategies for this work include the use of surveys, reviews of previous accident data.
5. Maintenance and other aviation applications
   Strategies for increasing performance on crew resource management.

B. Focusing Areas of Aviation Psychology

Developing solution counters or minimizes the influence of mental process of the flight crew and flight environment. Effective improvement in training procedures keeping them up to date.

C. Responsibilities of Aviation Psychology

- Air traffic control and stress burn out.
- To overcome the pilot's fear after an accident.
  Periodic classes should be conducted for motivation for flying and flight ability to overcome the fear of flying in pilots after an accident. The class should completely swept back the insecurity issues and fear of causing an accident or another's death.
  - Scientific and well defined approach is necessary to remove the fear of consequences of error in pilots. It can be done by activity breaks, mandatory and flight rest periods.
  - Optimize anxiety during flight operation.
  - Selection training and licensing of potential employers.
  - Optimization of working condition and system development in the aviation environment reduction of safety risks that protect employers from harm.
  - Accident and incident investigation.
  - Identify factors that cause issues on mental health of aviation workers.
  - Workload management.

III. WHY AVIATION PSYCHOLOGY?

Human errors have been documented as a primary contribution to almost 60 to 80% of commercial aircraft hull loss accidents. Accidents are due to the lack of concentration of the pilot or if the cargo receiver does not make full checks or the airplane mechanism fails to identify serious malfunctions. The impact of airplane accidents is due to the high altitude and very fast speed with which air plane travels. The reasons of aviation accidents can be considered into categories system malfunctioning, environmental issues and human error. As aviation psychology combines as teamwork, it should ensure the cooperation and coordination among the teammates. A relevant communication and positive crew climate enhances the standard of work.

A. Reasons for human error

- Lack of training and low confidence level contributes to pilot error.
- Crew coordination issues, include variations in the acceptance of automated technology .they have to cope with different workmates on different routes and need to adjust with emergency situation during their flight which includes system failure or medical emergence.
- Physiological psychology
  These include traditional measures such as heart rate and electroencephalogram (EEG).
- Security issues
- Fatigue, body rhythms, sleep and fitness.
- Fatigue and flight operations
  Both physical and mental strain can reduce the capability of human performance in psychology. Thus it increases the risk of safety in aviation.
- Interpretation of various factors such as negative self communication, work increased anxiety, depression and copying behavior leads to physical and mental discomfort.

B. Methods to reduce human error

- Wireless technology in airlines

- Reliable and required information can be share amongst ground crew and airborne staff in support to ensure safe flight operations.
- Personal protective equipment (PPE) in the aviation industry
  PPE enhances the protection of user from hazards. The term PPE refers the specialized clothing and equipment which employers wear in order to prevent themselves against the safety and health hazards.
- Knowledge of sensory process and warning devices, understanding visual detection capabilities for pilot.
- Detecting defects in manufacturing or maintenance inspection process and aeronautical decision making skills.
- 58 pilots completed the Pilot Reliability Certification (PRC) training program, a human factor training curriculum focused on personnel vulnerability to human error and counter measures in support of aviation safety.

Findings from cockpit management

attitudes questionnaire, a quantitative instrument designed to measure attitude changes, subjective reactions, showed that participants perceives the PRC training to be more detailed and in depth than was human training factors and showed a significant improvement in attitudes towards reducing human error in the cockpit.

- New training technologies
  Use of computer based training and part task stimulator and hence replacing conventional flight instruments.
- Airlines must be guaranteed about the mental health of the aviation personnel with the certification of a qualified psychologist.
- Assessment centers for evaluating psychometric intelligence test, conflict resolution and personality.
- Implementation of advanced technologies such as Automatic Identification of Risky Weather Object in Line of Flight (AIRWOLF) for the earlier detection of weather condition by alerting the controller about the hazardous weather.
- Effective application different visual and display characteristics.
- Installation of voice interactive system, fly by wire control system, emergency air to ground communication.
- Work breaks
- It is necessary to adjust one position frequently to keep the blood flowing to avoid cramping.
- Consideration of next level Air Transportation System (Next Gen) technologies.
- Risk associated with supervisory failure
  Unacceptable risks due to unsafe supervision which adversely affect the performance hence need to focus on proper appropriate crew scheduling and operational planning.

IV.UNEXPECTED THREATS

Unexpectedly occurring threats such as flight aircraft malfunction that happens suddenly without warning. The self communication may do not cooperate with what pilot detect on the instrument. Low satisfaction and adaptability in the job deviates the mind of pilot providing more chances of error. Misunderstanding of instruction and false training and ignoring the flight warning system are some other causes of aviation failure.

V.CONCLUSION

The studies are consistent with negative influence of performance, psychological health conditions and emotional stability as well. In investigation demonstrates the human factor problem associated and useful tools for guiding and improving the overall quality in the field of aviation, hence reducing the gap between the theory and practice. Limitations to the study are the restricted knowledge of the subject and improper handling. Future research in Aviation Psychology may yield divergent results in aviation with increased flight safety preventing performance decline.

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Recent years, the internet has witnessed an aggressive growth in the amount of learning resources. This explosion of learning resources on the internet has been accelerated by expanding interest for online learning resources by learners in e-learning environment. With this expansion of web based learning resources, learners are experiencing challenges in deciding learning resources that are valuable and significant to their learning needs. Recommender systems can overcome this issue by filtering out inappropriate learning resources and automatically recommending suitable resources to the learners according to their preferences. Learner preferences are relevant learning resources that meet their needs and interests.

An e-learning recommender system recommends a task to a learner in view of the undertakings effectively done by the learner and their successes. Certainly it is a revolutionary way to bring education in life long term comparing with the traditional learning system. The e-learning recommender system suggests online learning objects to learners, based on their preferences, browsing history of other learners with similar interest. The similarity of the learners could be established based on common previous access patterns made by other similar learners, or using user profiles.

II. TYPES OF E-LEARNING RECOMMENDER SYSTEMS

There are different approaches used to build a recommender system in e-learning context, some of them are:

A. Collaborative recommendation approach

This is one of the widely implemented recommendation techniques in data mining. It is based on the assumption that "similar users have same preferences" [2]. This technique aggregate rating of objects to recognize commonalities between learners and generate new recommendations based on inter-learner comparisons. A learner profile consists of a vector of learning objects and their ratings. Ratings indicate the degree of preference. It may be binary (likes/dislikes) or real-valued. Two classes of collaborative recommendation are:

i. Memory-based: Memory based technique can be classified into user based and item based. The user-based model is based on the fact that each learner reside on a group of similarly behaving learners and find a set of learners with similar preferences. Finally, it generates a list of recommendation for the target learner. The item-based model identifies the set of learning object that are similar or related to the target learner liked objects. After that, it computes the similarity of learning objects and finds the most similar objects to the target objects within the set of learning objects that the learner has rated.

ii. Model-based: Model based techniques provide recommendations by estimating statistical models for learner ratings. A probabilistic method can be used to compute the probability that the learner will give a particular rating to a new learning object based on previously rated objects.

Advantage: Does not need a representation of items in terms of features.

Limitations: Challenges like cold start, Sparsity problem and scalability issues.

B. Content -based recommendation

This technique is based on a comparison of the content of a learning objects and a learner profile. The content information can bridge the gap between the existing and new learner as well as the learning objects. The two classes of content based recommendation are:

i. Case based reasoning techniques: A case based reasoning technique recommends learning objects that are in highest correlation to objects the learner liked in the past. This technique does not desire a content analysis. The quality of the recommendation rises over when the learners have rated more learning objects. The new learner problem also stated to case based reasoning techniques. The limitation of this technique is overspecialization, because it recommends only the learning objects that are in higher correlation with the learner profile or interest.

ii. Attribute-based techniques: In attribute-based techniques, learning objects are recommended based on mapping of their attributes to the learner profile. Attributes could be weighted for their relevance to the learner [3]. This technique is sensitive to changes in the learner profile. Adding new learners or learner attributes will not cause any problem. The limitation of this type of recommendation is that it is static in nature and is not able to understand from the behavior of the network. Attribute-based technique can handle the cold-start problem because it directly maps characteristics of learners to learning attribute and the behavior data about the learners is not needed.

Advantage: Doesn't require data of other users.

Limitation: Over specialization.

C. Utility-Model based recommendation

This system does not attempt to build a long term generalization about their learners but rather base their advice on an evaluation of the match between a learner's need and the set of available options [4]. It makes suggestion based on computation function of the utility of each learning objects for the learner. The learner profile is considered as the utility function and the system employs constraint satisfaction methods to determine the finest match.

Advantage: Can factor non-object attributes.

Limitation: Learner must input utility function.

D. Demographic recommendation

This technique classifies the learners based on their personal attributes and the recommendations are based on the demographic classes. This approach is based on the assumption that all learners belonging to a certain demographic class have alike interest or preference. It uses demographic data about the learner and their point of view for the recommended learning objects. It forms people to people correlations like collaborative ones. But they use different data [4]. In systems like machine learning, it is used to reach at a classifier based on demographic data [5].The benefit of this approach is that it is independent of learner rating history.

Advantage: It does not require history of learner ratings.

Limitation: Security and privacy issue.

E. Context-aware systems

Traditional recommender systems compromise with two types of entities, users and items. The recommender system includes additional information about learners context such data can be used to change recommendations based on individual learner

characteristics and additional contextual information such as available time, location, people nearby, etc. Context is information that can be used to classify the situation of an entity [6]. An entity is an object, person or place that can be considered relevant with the interaction between an application and a user [6]. The context data consists of different attributes, like physical location, date, season, emotional state, physiological state, personal history etc. This system automatically uses context data to run the system that are suitable for a specific time, places or events. It was integrated to improve the existing learner request response pattern that requires the learners to raise the wish for recommendation. The traditional recommender system focused on suggesting the most essential learning objects to learner without considering any additional contextual information, like location, emotional state and physiological state. It is necessary to combine the context data into the recommender systems so as to recommend learning objects to the learners under some circumstances. It covers the understanding of learner's objective with objects that learners might find interesting by knowing the wide area of contextual attributes.

Advantage: Based on changing contexts the recommendations can be adjusted.

Limitation: Need to integrate contextual data.

F. Hybrid recommender system

Hybrid filtering is a collaboration of two or more different recommendation approaches. Depending on domain and characteristics of data, several hybridization methods are possible to combine collaborative recommendation and content based recommendation techniques which may produce different outputs. Some of them are [7] mixed, weighted, feature augmentation, switching, feature combination, cascade etc. The widely known hybrid approach is provided by collaborative recommendation and content based recommendation. The collaborative recommendation is based on a similarity between the learner navigation path and the access patterns of similar learners. Content based recommendation is based on the correlation between the content of the learning objects and the learner taste. Hybrid recommendation tries to overcome the limitations in each approach, by making the collaborative recommendation deal with any type of content and explore new area to find something that is interesting to the learner.

Advantage: No cold start problem.

Limitation: Issue on Time complexity.

G. Knowledge-based recommendation

This recommender systems attempts to propose objects based on a learner needs and preferences. It contains knowledge about how a specific learning object meets a specific learner need. Therefore it can be a reason about the relation between a need and an achievable recommendation. The learner profile can be any knowledge structure that supports this conclusion. This technique collects knowledge about the learners and learning objects to apply them in to the recommendation activity. It is independent on learner ratings. It does not collect data about a specific learner because its intuition is independent of individual preferences. Knowledge-based techniques are suitable for hybridization with other recommendation techniques in the case of e-learning recommenders [8].

Advantage: Independent of learner ratings.

Limitation: Requirement of knowledge acquisition.

H. Ontology-based model recommendation

Ontology is an explicit specification of a conceptualization [9]. It consists of entities, attributes and relationship [9]. Ontology is used to model knowledge about the user background, item, and the domain [6]. The use of ontology can effectively improve the quality of personalized recommendation. Ontology is used to model the domain knowledge about the learner as well as the

learning objects. The learner model ontology contains the personal information, learning style and knowledge level of the learner. The learning object ontology contains resource types, resource format. Personalization through ontology provides a more customized recommendation to the target learner preference. Ontology based recommendation do not experience most of the problems associated with traditional recommender systems.

Advantages: It depends on domain knowledge rather than ratings and improves the quality of personalized recommendation.

Limitation: Construction of ontology is a difficult, expensive and time consuming process.

III. GENERAL CHALLENGES AND ISSUES OF E-LEARNING RECOMMENDER SYSTEMS

Recommendation techniques have been very successful in past years but their wide use has exposed some challenges. Some of them are:

I. Cold-start problem

It is mainly based on new user or new item. This problem occurs due to an initial lack of ratings for new users who have not rated any item or new items which have not been rated by any user. Hence it becomes unattainable to make good recommendations.

New User: It occurs when there is a new learner to the system has no prior rating found in the rating table. So it is difficult to give prediction of a learning object for the new learner because it requires the learner's historic rating to calculate the similarity for determining the neighbors. Here the recommendations follows a comparison between the target learner and other learners based on their ratings, a learner with few ratings are difficult to classify.

New item: Cold start problem for a new learning object occurs when there is no enough previous rating related to that learning object exists [10].

II. Sparsity problem

Sparsity problem occurs where the number of learners who have rated learning object is too small compared to the number of available learning objects. If there is no such overlap in ratings with the target learner occurs, it is difficult to generate appropriate recommendation [9]. The main cause for data sparsity problem is that most of the learners do not rate most of the available learning objects. It has a major negative impact on collaborative recommendation approach because it is highly probable that the similarity between two given learners is zero, lay down collaborative recommendation useless.

III. Over Specialization

This is the major problem faced by the content-based recommender system. It lacks in suggesting diverse learning objects. The learners are recommended with learning objects that are already familiar with. It prevents learners from finding new learning objects and other alternatives. Additional techniques have to be added to the system to make suggestion outside the scope of learner interest. By integrating additional methods the learner will be provided with a set of different and a wide range of options [11].

IV. Scalability

As the numbers of learners and learning objects grow, traditional collaborative recommendation will suffer serious scalability issues [12]. In collaborative recommendation calculation grows linearly with the number of learners and learning objects, sometimes lead to inaccurate results.

5. Privacy

In the context of a demographic recommender, privacy is considered to be a major issue [10]. In order to provide more accurate recommendation to the learner, the most sensitive data of a learner must be acquired. It includes demographic information and information about the location of a specific learner, which may rupture the privacy of the learner.

IV. CONCLUSION AND FUTURE SCOPE

This paper surveys on various traditional recommendation techniques used in an e learning platform and also considered their advantages and limitations. A recommender system tries to intelligently recommend actions that are beneficial to the user. The development of sophisticated e-learning environments provides a path to education in life for long term. In an e-learning platform, the recommender system tries to intelligently recommend learning objects to a learner based on the task already done by the learner and their success. With the development of e-learning platforms, personalization is becoming a consequential feature in e-learning context. It is due to the dissimilarities in goals, backgrounds and capabilities of the learners. The future work will focus on incorporating intelligent technologies from field deep learning to enhance the recommendation performance and accuracy of the recommendation approach.

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