Impact of Learning Style Preferences and Social Media Use on the environment of Distance Learning for Engineers in the Vertical Transportation Industry

Thomas Ehrl[1], Stefan Kaczmarczyk[2], Jonathan Adams[2], Benedikt Meier[3]

[1]thyssenkrupp Steel Europe AG, Kaiser-Wilhelm-Strasse 100, 47166 Duisburg, Germany,
[2]School of Science and Technology, University of Northampton, St. George's Avenue, Northampton NN7 3NG, UK,
[3]thyssenkrupp Industrial Solutions AG, Rellinghauser Strasse 1, 45128 Essen, Germany,

Keywords: Learning, Training, Adult Education, Training Concepts, Social Media, Engineering, Learning Style Preferences, Vertical Transportation

Abstract. The world became a digital world, where the internet and modern communication channels have changed the way people interact and communicate with each other.

On the other hand, digital technology drives the concepts of advanced learning and allows access to learning environment anytime, anywhere.

Based on the results of a quantitative survey conducted with participation of engineers and students across the entire world, a new pedagogic concept for Distance Learning (for the subject of Advanced Machine Dynamics) has been developed in this study.

The paper examines the concept and structure of the survey and looks into the analysis of the results. Furthermore, it emphasizes the impact of Social Media on the success and effectiveness of learning considering different Learning Style preferences.

The paper concludes with recommendations to improve the Distance Learning mode of delivery to ensure a learner-centric approach and optimized learning results.

The results of this study, combined with the results of research projects that focus on the performance of rope-less Passenger Transportation Systems, will help to improve the Learning Environment and concept of Distance Learning for engineers in the Vertical Transportation industry.

1 INTRODUCTION

Learning is the driver for the development of the human species and an ongoing process to pursuit knowledge. This knowledge transfer changed over the last decades through permanent scientific innovation and evolving technology (typography, personal computers, internet).

Also, the way the learning process is understood altered, as - in many cases – today, learning (to acquire knowledge), goes together with the application of that specific knowledge (e.g. at a workplace) [1]. The effectiveness of that knowledge transfer process is a condition of the way a human being receives that learning content; it depends on the individual Learning Style, which is the method a person uses to learn or study [2].

This paper evaluates the interaction of learning preferences and modern communication channels and proposes a state-of-the-art concept for efficient and effective Distance Learning courses in Engineering Education.

2 LEARNING STYLES

In general, learning can be categorized into the following types:

- *Auditory Learning,*
- *Visual Learning,*
- *Haptic Learning and*
- *Intellectual Learning*

While auditory, visual, and haptic learning are somewhat related and all focus on perceptions and inputs that come through the same type of nerve cord, intellectual learning is different in its receptive channel.

Bloom's Taxonomy splits types of learning into the following levels [3]:

- *Remembering (Recall or recognition of an expression.)*
- *Comprehension (Understanding of facts. Ability to organize them and bring into relation.)*
- *Application (Deeper understanding. Use/apply information for related problem solving.)*
- *Analyzing (Break-up information into smaller chunks, organize them and relate them together.)*
- *Synthesizing (Ability to structure patterns from given/known information. Develop ideas and critical doubts about the subject.)*
- *Evaluating (Ability to take in external information and relate your knowledge to them to make decisions.)*

Those six levels work in hierarchical order with *Evaluation* as the highest level of understanding and *Remembering* on the other end. This categorization is important for the development of learning concepts and training outlines.

Every individual, however, has their own way to receive and process information. When it comes to the process of studying or learning, we can observe a number of different kinds of learning style preferences.

We can categorize the following types of learners [4,5]:

- Visual, aural and verbal learners;
- Social (active) and solitary (reflective) learners and
- Physical (sensing) and logical (intuitive) learners.

Other sources also blend learning style preferences with the way people pick up information (sequential/systematic and global/random learners) [6]:

- Sequential learners have a tendency to gain understanding in linear steps (one step is logically following from the previous step),
- While Global learners tend to learn in bigger steps, randomly absorbing content with probably no obvious connections, however, finally they "get it".

2.1 Visual, aural and verbal learners

Visual learners (a.k.a. learners with a visual learning preference) remember content best, when they see for instance pictures, diagrams, flow charts or video sequences, while Verbal learners gain more out of words and text in written. Aural learners get most out of sound and spoken explanations.

2.2 Social and solitary learners

Social learners tend to keep and understand information best by doing something active with it (for example: applying/discussing/explaining. Social (reflective) learners tend to enjoy group work and workshops more than solitary learners, who prefer working alone (reflection).

Reflective learners prefer to think about it for themselves in the first place.

Sitting quiet throughout lectures only taking notes is hard for these two learning types, but even harder for social learners.

2.3 Physical and logical learners

Physical learners tend to like content such as facts and figures, while logical learners often prefer to discover possibilities and inter-relationships.

Everybody has a preference for a specific learning style and sometimes tends to the opposite the other day. Our preferences for one or the other maybe strong, moderate, or weak.

To be an effective learner or problem solver, people should be able to function in both directions of a category.

3 MODERN SOCIAL INTERACTION

3.1 Importance of Social Interaction

"Social interaction is the reciprocal influence human beings exert on each other through inter-stimulation and response."[7]

This definition obviously emphasizes two main conditions of social interaction: social contact and communication. For social contact in our context, mental, not physical, proximity is essential and it may be direct (involves the presence of persons) or indirect (through any means of communication, such as telephone or TV), and positive (directs to tolerance, compromise or cooperation) or negative (leaves a feeling of i.e. hate, rival or jealousy). That social interaction works via communication and has a central place in society and is a necessity for social contacts. Today, it varies from writing a letter, to the communication means of the 21st century.

3.1 Social Media

Social Media refer to forms of digital platforms, whether mobile or stationary, involving interactive (human) participation. Social Media is the entirety of interactive online collaborative channels dedicated to input and shared content coming from the participating community. [8]

Amongst other types of Social Media, Facebook, WhatsApp or Bebo replaced the very well established one-to-one communication such as face-to-face conversation or telephone calls. In any way, a social interaction or social relation is the way people talk and act with each other and includes interactions in a team, or family and incorporates any relationship between two or more individuals. It is an important source of socialization and characterizes all different types of social relationships. As a university environment represents a subgroup or society with a specific intention, Social Media seems to be an obvious tool to communicate up-to-date in this context. [9]

There are few rationales of Social Media existing:

- Create a community → Social Media helps to centralize the knowledge of a specific class, which studies the same topic at the same time, and helps increasing the communicating efficiency (even with the involvement of a professor or teacher).
- Continue the conversation → Social Media helps individuals to tap into a study group when classes have been missed or ask questions to experts.
- Organize learning resources → Tools provided within Social Media networks help keeping course content organized and offer ease access to it.
- Supplement course materials → Social Media helps identifying additional topic content to amend the initial instruction.

Social Media can help students to create and manage a study community to gain the most efficiency and effectiveness out of available study time and to find additional resources to supplement studying.

4 THE SURVEY

To identify a correlation between Learning Style preferences and the usage of Social Media, a questionnaire has been designed to verify (or disprove) these theses [10].
Within a timeframe of October 25, 2018 and December 31st, 2018, 353 replies were counted after accessing the following student and engineering populations through an official invitation:

- Global R&D workforce of a German Lift manufacturer
- Student force of the University of Northampton, UK
- Student force of Georgia Institute of Technology, U.S.
- Student force of Shanghai-based Tongji University, P.R.C.
- Student force of the University of Stuttgart, GER
- Student force of the University of Applied Science Furtwangen, GER

4.1 Survey design

The idea of that completely anonymous survey is to find out (through self-assessment) individual Learning Styles and the individual need to interact with other learners. These very specific characteristics differ from person to person and correlate to different experiences of one´s socialization in the past [11].

The considered survey result will be incorporated into a new Learning Model and consequently into the design of a short analytical task on the subject of Machine Dynamics, which will be carried out via Distance Learning. Thereafter, an engineering student cohort will conduct a second Distance Learning item that follows this new Learning Model.

A second cohort will be the reference group by following the old distance learning approach.
Both cohorts finish their assessments with a small exam to prove and compare the learning success. That result is used to finally evaluate the new learning concept.

The principle workflow of the study is shown in Fig. 1.

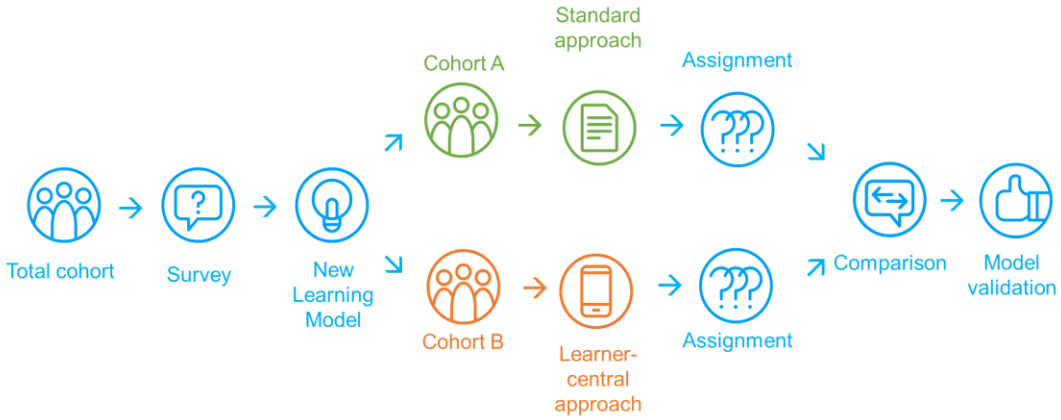

Figure 1: Study design

4.2 Survey results and implications

The total number of replies to the survey is 353 with the following distribution to age, gender, profession, and geographical region as shown in Fig. 2:

- 44% are younger than 30 years
- 74% are Male
- 54% are Mechanical Engineers
- 53% are based in Asia; 38% are based in Europe

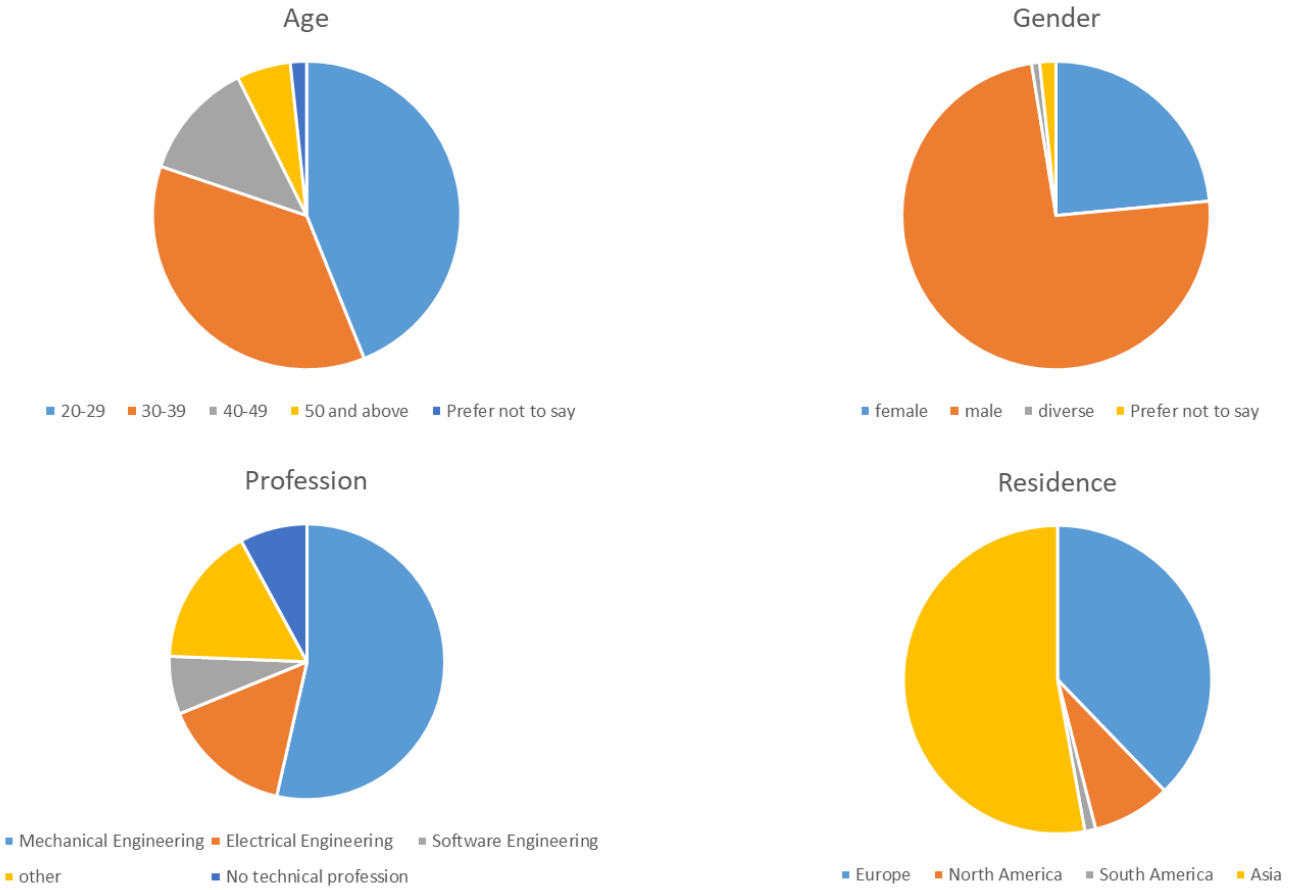

Figure 2: Survey main data

This outcome of randomly contacted and globally distributed survey replies corresponds to the multi-national global R&D population of thyssenkrupp Elevator, one of the lift manufacturers with global operations.[1] This means: The data shown refers to an unrelated global engineering population but is pursuant to the R&D population of this specific lift manufacturer.

The lift business itself is a global business with country or region specific safety regulations, such as EN 81, and therefore it is essential for global enterprises to have a diverse staff population that is familiar with these regulations and local markets.

Engineering topics specific for lift engineers include, but are not limited to [12]:

- Lift Applications Engineering (important mathematical, mechanical and electrical processes and mechanisms involved) with an exploration of the parameters effects influencing the overall performance of the lift system
- Codes and Standards
- Lift Control Systems
- System Dynamics and Vibration
- Hydraulic Systems
- Lift Component Applications
- Microprocessor Applications
- Utilization of Materials

[1] According to the General Data Protection Regulation, individual information (e.g. gender or age) has to be handled very sensitively and therefore cannot be published. The author of this paper has the data analysis at his disposal accordingly.

- Vertical Transportation Systems

The detailed analysis of the survey results shows the following findings:.

4.2.1 Real friends or just a collection of contacts?

Interviewed persons, who stated that they know all or most of their social network, show a tendency not to prefer using body, hand and/or sense of touch when learning something new.
However, the majority of this group (52%) says, that they prefer logic and reasoning to learn best.
Logically, this part group uses social networking sites more likely that the total population of interviewees.

It is to prove why this part group is younger than the total population.

On the other hand, there is a significant shift to a higher degree of "unknown" friends in the social network of people from Asia (mean rank moves from 2.8 to 3.6, with 5 possible answers from 1 = "I know all of them" over 3 = "I know about half of them" to 5 = "I know none of them").
Another significant difference is obvious, when it comes to the degree of "friends" met in person in social networks of participants from Europe, North America and Australia. Here 84% of the population state that they know most or all of the "friends" of their social network.

4.2.2 Solitary learners

45% of the total survey participants called themselves a Solitary Learner ("I prefer to work alone and use self-study.") and logically claims that it helps them to understand something, when they think about it by themselves.
However, 55% prefer to learn in groups or with other people.

4.2.3 Devices

Throughout the entire survey population, the preferred device to connect with the internet are laptop and smart phone.

4.2.4 Places to study

86% of the participants of the survey claim that they are at home when studying or attending online courses

4.2.5 Preferred media

Almost 60% of the total survey participant group prefers to read digital academia articles or eBooks and to watch videos.

4.2.6 Recap difficult topics

For 60% of the interviewed persons it is helpful, when they talk to someone to understand something.

4.2.7 Just listen or be active

For a classic classroom situation, 59% of the survey participants claim to learn better, when they can actively bring in their ideas.

4.2.8 Daily time spent online

46% of the participants coming from Europe, North America or Australia are spending at least 3 hours online

4.2.1 Learning style preferences

When it comes to learning style preferences (see chapter 2 LEARNING STYLES), there are significant different shapes of the distribution of the specific degree of preference.

- Visual (question 1): 64% moderate or high degree
- Aural and (question 2): 26% moderate or high degree
- Verbal learners (question 3): 50% moderate or high degree
- Physical/sensing learners (question 4): 37% moderate or high degree
- Logical/intuitive learners (question 5): 69% moderate or high degree
- Active learners (question 6): 64% moderate or high degree

4.3 Implications and new pedagogic model for Distance Learning

Learning by itself can be described as a transformation process, and the model illustrated in Fig. 3 shows the important interactions within the learning process [13] enabled by technology.

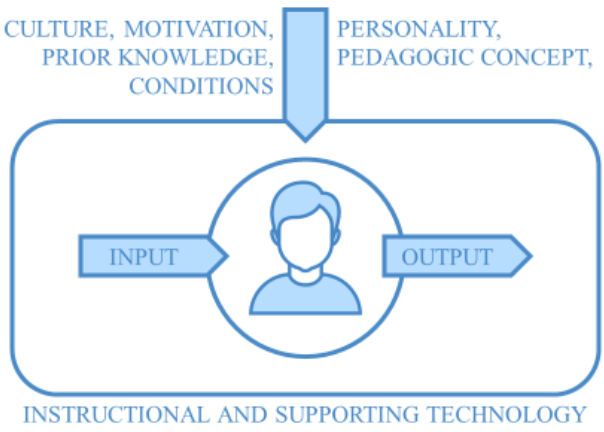

Figure 3: Transition Model of Distance Learning

Based on the survey results and the following statements (derived from the survey)

- Social networks are working in the same way with real friends (known in person) or unknown people.
- People are used to studying for themselves.

- People like to study at home.
- People like using laptops/tablets or mobile phones to study.
- People are used to reading online sources and prefer video clips.
- People like to recap difficult topics with others.
- Online sources are used for a significant time of the day.
- The most prominent shapes of learning style preferences are visual, logical and active.

A new model to capture the student needs and to respect the differences in Learning Style is suggested. This new model (shown in Fig. 4) considers the following aspects and therewith it represents a new pedagogic model for Distance Learning to improve its effectiveness:

- A social network needs to be established (within the student population) to enable students to recap difficult topics with other students.
- Learning formats have to be responsive to ensure the application via mobile devices and include visual content.
- The learning content should challenge the learners with logical context and should animate them to actively use other senses.

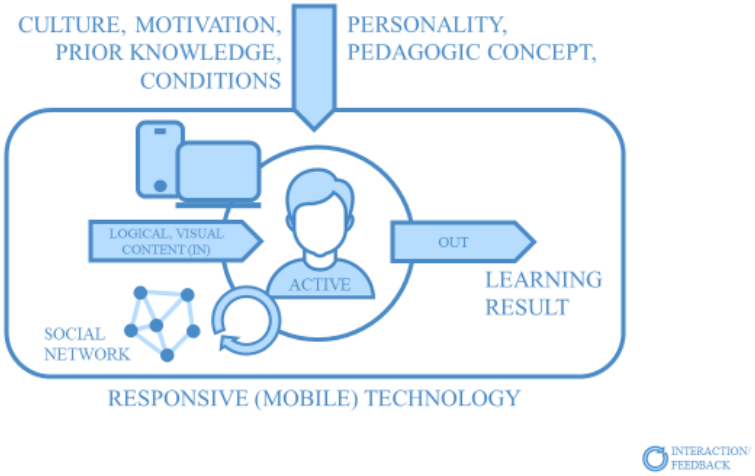

Figure 4: New Model for Distance Learning

5 CONCLUSION

The results of the survey show that there are no significant differences between geographical regions, although assumed initially. However, the number of real “social media” friends is different, when comparing Asia with Western cultures. For both geographical regions, Social Media is the perfect complement to Distance Learning to enhance the student interaction.

Out of six different learning style preferences the most common seem to be visual, logical and active, of which all can be integrated into new learning formats.

As people usually study at home, Social Media seems to be a kind of window to the outside world and therefore should be incorporated into the pedagogic concepts of the future Distance Learning courses. On the other side, it is highly recommended to motivate Distance Learning students to initiate and maintain their own and topic specific communication channels via Social Media.

For distance learning programs, such as the MSc Lift Engineering course at The University of Northampton (UoN), this new pedagogic concept offers a huge potential to increase the efficiency and effectiveness of such a program.

The MSc Lift Engineering program delivered, offered through distance learning by experienced academics and practitioners from the national and international lift industry, benefits lift engineers and consultants as well as members of senior management in the lift industry. A virtual learning environment delivers online sessions that can be accessed from anywhere in the world.

That UoN learning environment will undergo an improvement process to apply the findings of this paper and to strengthen its best practices.

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BIOGRAPHICAL DETAILS

Thomas Ehrl, thyssenkrupp Steel Europe AG, Germany

Mechanical Design Engineer (degree in 1994), Part-time PhD student with the Faculty of Arts, Science and Technology of The University of Northampton. Professional career started in 1994.

Since 4/2008 with thyssenkrupp:

- Head of Learning & Transformation Delivery of thyssenkrupp Steel Europe AG, Duisburg/GER
- Head of seed campus Global of thyssenkrupp Elevator AG, Essen/GER
- Head of Research & Innovation Center of thyssenkrupp Elevator Innovation GmbH, Rottweil/GER
- Engineering Training Manager at Corporate Level of thyssenkrupp Elevator AG, Essen/GER
- Manager R&D Project Standards at Corporate Level of thyssenkrupp Elevator AG, Cheonan/South Korea and Essen/GER

Interests: Family life, cooking, dog (charcoal labrador), travelling, running, soccer, music, and vintage English motorcycles. Networking.