ALGORITHM-BASED TRAINING AND DEVELOPMENT FOR WORKPLACE WELL-BEING ENHANCEMENT: A NEW PRACTICE IN ELECTRONIC HUMAN RESOURCE MANAGEMENT

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ABSTRACT

Aim: examine the role of algorithm-based applications in computerized interventions for workplace well-being enhancement

Methodology: Realist synthesis (RAMESES method), based on 7 reported computerized interventions on example of standard computerized Cognitive Behavioral Therapy (iCBT)

Findings:

- Algorithm-based applications mainly play the role of IT tools concerned with administrative Human Resource (HR) functions, when the workplace is an intervention location.

- They mainly play the role of IT tools concerned with supporting business processes, when the workplace is an organizational context of an intervention.

Conclusion: Algorithm-based administrative support, training and development for workplace well-being enhancement represent new electronic Human Resource practices (e-HR practices).

BACKGROUND: WORKPLALCE WELL-BEING

- "Workplace well-being relates to **all aspects of working life**, from the **quality and safety of the physical environment**, to how workers **feel about their work**, their **working environment**, the **climate at work and work organization**" (International Labour Organization, 2017, p. 1).

- **International regulatory bodies consider the workplace well-being enhancement as social and legal responsibility of employers (European Agency for Safety and Health at Work, 2017; Gervais, 2017; Stavroula, 2008).**

- One of the ways to enhance the workplace well-being is to reduce the work-related **psychosocial stress through psychosocial interventions, also labelled as interventions** (Stavroula and Tom, 2008; Hon et al., 2013; Tetrick and Winslow, 2015; Cooper and Cartwright, 1997).

BACKGROUND: WORKPLACE WELL-BEING ENHANCEMENT

Interventions are programmed activities coordinated by an employer at organizational level in the context of **psychosocial stress management** in the workplace (Stavroula and Cox, 2008, p. 138).
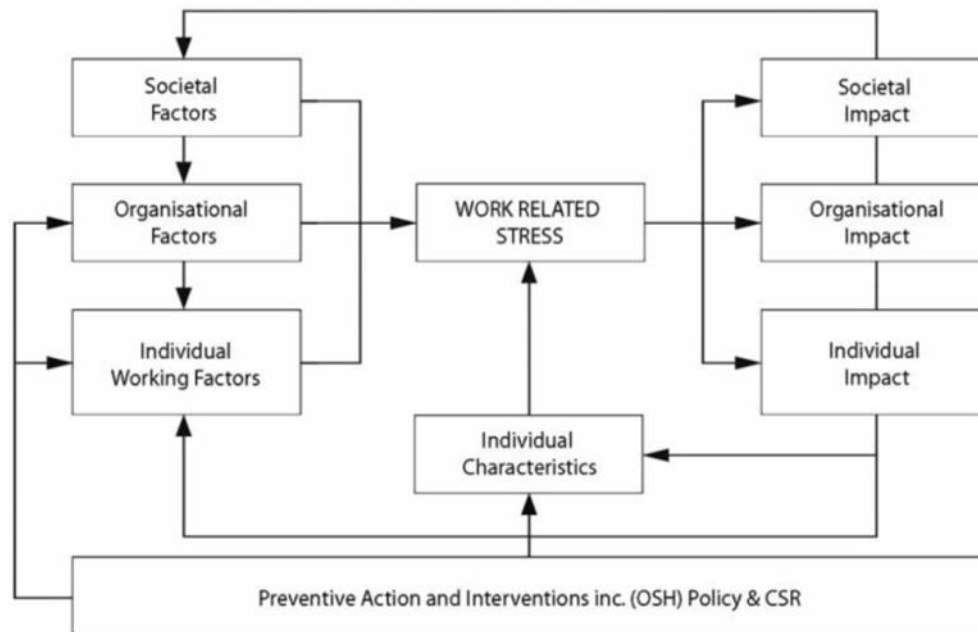

Figure 1.   Indicator Model on Psychosocial Risks at Work (Stavroula and Cox, 2008, p. 20)

BACKGROUND: COGNITIVE BEHAVOUR THERAPY

- **Algorithm-based applications** influence the delivery mode, intervention design, implementation and effectiveness evaluation (Imamura et al., 2015, p. 579).

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Program Reviews

PROGRAM REVIEWS

GET.ON Recovery

Online-Therapy.com

OUR PROGRAMS   HOW IT WORKS   FAQ   REVIEWS   AFFILIATE   ABOUT   THERAPIST?   LOG IN

TEST TO SEE YOUR PROGRESS

At the beginning of your program, you will complete a simple test with questions that will allow you to address and evaluate your problems, possibly for the first time. Later on in the program, you will use this test as a reference point, so that you can actually see the progress you have made.

Online-Therapy.com

The test is not to be seen as a final diagnosis. If you are uncertain about your result, we suggest that you get professional help as soon as possible.

	True	Partly true	Not true
1. I often feel stressed and tense.	●		
2. I am not satisfied with my life.			●
3. I don't feel good about myself.		●	
4. I have stomach cramps, diarrhea or other digestive problems.	●		
5. I don't feel secure.			

OVERVIEW

A program for improving insomnia resulting from work-related stress with content addressing sleep and separation from work.

GET.ON Recovery is an intervention for treating insomnia related to work. The intervention includes six 45-60 minute sessions focusing on psychoeducation, information on sleep hygiene, setting boundaries between work and home, and coping with work-related stress. Content is delivered using text, video, and audio. Users can keep diaries about sleep, work related stress, and recreational activities. Each session includes exercises to complete during that session and homework to complete between sessions. Users receive answers to questions, reminders to complete the program, and feedback on completion of program sessions and homework from a coach through the program website.
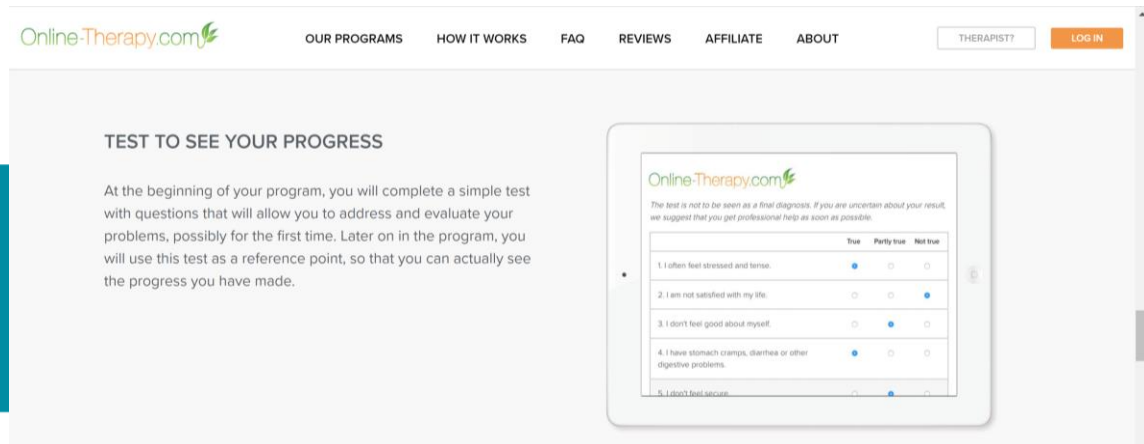
Dutch online-based intervention "Alles onder controle" (everything under control), internet-based guided self-help intervention aimed at reducing depressive symptoms among employees

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BACKGROUND: RESEARCH PROBLEM

Evidence regarding the effectiveness of interventions for workplace well-being enhancement remains fragmented due to:

- Complexity,
- Vast variety of targeted outcomes, intervention design, content, and delivery,
- Lack of connection between the literature on Occupational Health and Human Resource Management.

Evidence regarding the effectiveness of computerized interventions for workplace well-being enhancement remains fragmented, too.

- There is a **research gap in the literature regarding the relationship between the algorithm-based applications and workplace well-being.**

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RESEARCH AIM AND QUESTION

The aim of this research is to fill this gap by examining the role of algorithm-based applications in computerized interventions for workplace well-being enhancement.

Those facts motivate the research question:

➔ **Which role do algorithm-based applications play in computerized interventions for workplace well-being enhancement?**

METHODOLOGY

- **Narrative literature review** in line with RAMESES guidelines (Wong et al., 2013)

- **Literature source selection** for the narrative literature review

- **Realist analysis** of computerized interventions with algorithm-based applications according to PICO dimensions (Participants, Intervention, Comparison, Outcomes) (Cleyle and Booth, 2006)

- **Realist synthesis** with purpose to build a new theory regarding the role of algorithm-based applications in workplace well-being enhancement

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METHODOLOGY

- **Realist synthesis is performed in line with RAMESES** narrative literature review guidelines in order to:

  1. Identify the existing **theoretical premises** that will guide the explanations, based on results of literature analysis

  2. Identify the links explaining combination of factors **(demi-regularities)** and the way in which those factors influence the intervention outcomes **(mechanisms of influence).**

  3. **Develop a new theoretical proposition regarding the role of algorithm-based applications in workplace well-being enhancement**
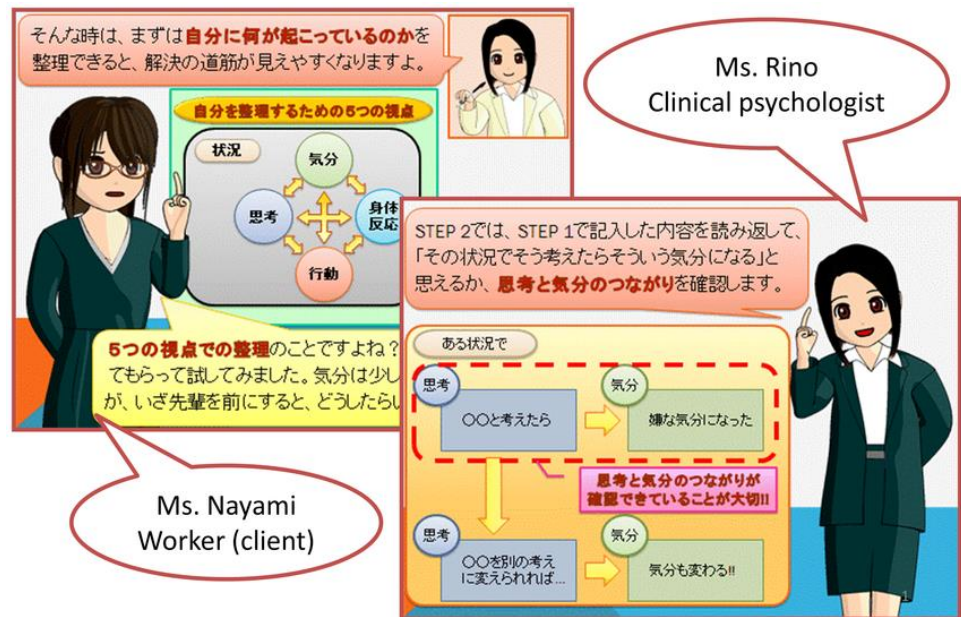
METHODOLOGY

- **Sample under examination**: Computerized interventions according to standard methodology of **computerized Cognitive Behavioural Therapy (iCBT)** to reduce the variety of targeted outcomes, intervention design, and delivery modes.

- CBT focuses on the development of personal coping strategies that target solving current problems and changing unhelpful patterns in cognitions (e.g. thoughts, beliefs, and attitudes), behaviours, and emotional regulation.

- It was originally designed to treat depression, and is now used for a number of mental health conditions, for example anxiety.
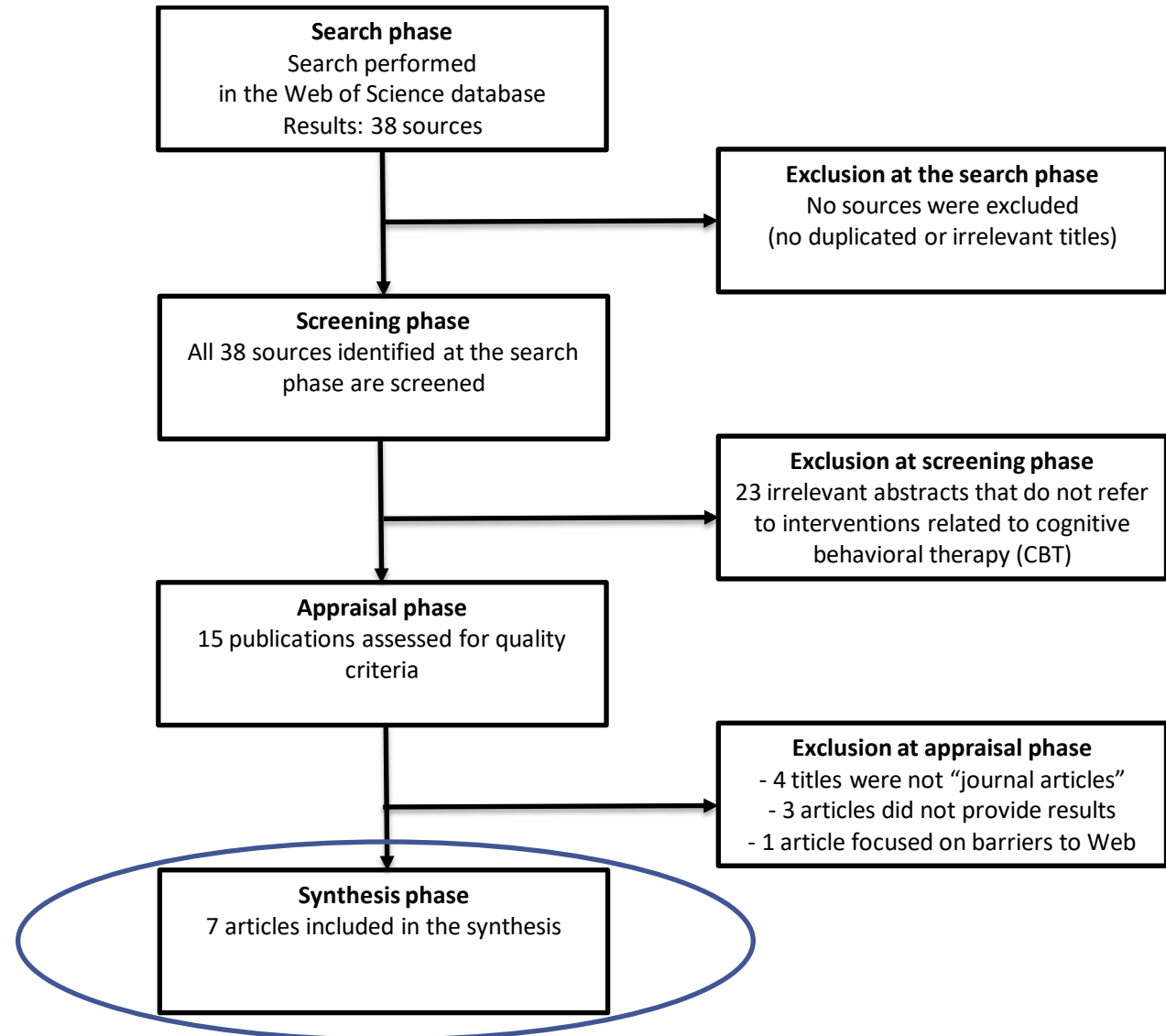
METHODOLOGY

- Employers are increasingly using **Computerized Cognitive Behavioral Therapy (iCBT)** programs for the workplace well-being enhancement of employees.

RESULTS: LITERATURE REARCH

Search phase
Search performed
in the Web of Science database
Results: 38 sources

Exclusion at the search phase
No sources were excluded
(no duplicated or irrelevant titles)

Screening phase
All 38 sources identified at the search
phase are screened

Exclusion at screening phase
23 irrelevant abstracts that do not refer
to interventions related to cognitive
behavioral therapy (CBT)

Appraisal phase
15 publications assessed for quality
criteria

Exclusion at appraisal phase
- 4 titles were not "journal articles"
- 3 articles did not provide results
- 1 article focused on barriers to Web

Synthesis phase
7 articles included in the synthesis

RESULTS: LITERATURE REARCH

Source Code	Title, Authors and Publication Year	Academic Journal
"Tan Trial"	Effects of an Internet-Based Cognitive Behavioral Therapy Intervention on Improving Work Engagement and Other Work-Related Outcomes: An Analysis of Secondary Outcomes of a Randomized Controlled Trial (Imamura *et al.*, 2015)	Journal of occupational and environmental medicine
"Blue Trial"	Effect of a brief training program based on cognitive behavioral therapy in improving work performance: A randomized controlled trial (Kimura *et al.*, 2015)	Journal of Occupational Health
"Red Trial"	Log in and breathe out: Internet-based recovery training for sleepless employees with work-related strain - results of a randomized controlled trial (Thiart *et al.*, 2015)	Scandinavian Journal of Work Environment & Health
"Olive Green Trial"	Efficacy of an internet-based problem-solving training for teachers: Results of a randomized controlled trial (Ebert *et al.*, 2014)	Scandinavian Journal of Work Environment & Health
"Purple Trial"	Long-Term Results of a Web-Based Guided Self-Help Intervention for Employees With Depressive Symptoms: Randomized Controlled Trial (Geraedts *et al.*, 2014)	Journal of Medical Internet Research
"Dark Blue Trial"	Efficacy of Cognitive Behavioral Therapy Training Using Brief E-mail Sessions in the Workplace: A Controlled Clinical Trial (Kojima *et al.*, 2010)	Industrial Health
"Orange Trial"	Stress management in the workplace: A comparison of a computer-based and an in-person stress-management intervention (Eisen *et al.*, 2008)	Computers in Human Behavior

Table 1 Document Characteristics.

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RESULTS: LITERATURE ANALYSIS

Code	Participant group (P)	Intervention design for evaluating the mental and work-related outcomes (I)			Comparison group (C)	Intervention outcome (O)			
		Interventionnalists	Intervention design	Treatment content strategies		Completion rate (%)	Depressive symptoms	Other mental health-related symptoms	Work-related outcomes
"Tan Trial"	381 healthy white collar workers (employees of two information technology companies in Japan)	Trained clinical psychologists; non-specialists under supervision	- Randomized controlled trial (RCT) - Participants had access to a web-based training course program in stress management skills, taking form of a Japanese comic story. The course comprised weekly 30-minute training sessions over 6 weeks.	Stress-Management techniques; Provision of peronalized feedback to participant (optional)	381 workers (groups at random assignment)	71%	No effect on depressive symptoms (Secondary outcome)		+ Work Engagement (Primary outcome) No effect on work performance (Secondary outcome)
"Blue Trial"	97 healthy white collar workers (managers, engineers, and office workers working in the headquarters of an electric company in Japan)	Occupational physicians	- Randomized controlled trial (RCT) - Brief training program based on Cognitive Behavioural Therapy, focused on short-term self-help. The intervention consisted of 1 group training session lasting 120 minutes and web-based homework to do over1 month.	Skill-Building techniques; Provision of information; Provision of automatized feedback to participant	99 workers (groups at random assignment)	87%		+ Self-evaluation of Cognitive flexibility (Secondary outcome)	++ Subjective work performance (Primary outcome)
"Red Trial"	64 white collar workers with subclinical mental problem symptoms (public school teachers that suffer from both work-related strain and sleep problems in Germany)	Clinical psychologist and trained coaches	- Randomized controlled trial (RCT) - Guided Internet-based recovery training with six 1-week modules was held for relieving insomnia in sleepless employees with work-related strain by promoting restorative sleep, mental detachment, recreational activities. Every session included homework regarding planning of recreational activities into daily life, monitoring sleep efficiency and continuing with sleep hygiene and restriction.	Provision of information; Skill-Building techniques	64 workers (groups at random assignment)	75%		++ Decrease of insomnia severity (Primary outcome)	

Table 2 Analysis of Interventions according to the PICO method: studies with workplace as delivery location are highlighted in gray

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RESULTS: LITERATURE ANALYSIS

Code	Participant group (P)	Intervention design for evaluating the mental and work-related outcomes (I)			Comparison group (C)	Intervention outcome (O)			
		Interventionnalists	Intervention design	Treatment content strategies		Completion rate (%)	Depressive symptoms	Other mental health-related symptoms	Work-related outcomes
"Olive Green Trial"	75 white collar workers with subclinical mental problem symptoms (public school teachers that suffer with elevated depressive symptoms in Germany)	Psychologists and trained master's-level psychology students who followed feedback guidelines	- Randomized controlled trial (RCT) - Intervention group received Internet-based problem-solving training, Internet-based guided self-help intervention aimed at reducing depressive symptoms.	Problem-Solving techniques; Provision of information; Provision of personalized feedback to participant (optional)	75 workers (groups at random assignment)	81%	++ Decrease of depressive symptoms (Primary outcome)	++ General and work-specific self-efficacy (Secondary outcome) ++ Health-related quality of life (Secondary outcome) '++ Decrease of perceived stress (Secondary outcome)	No effect on actual burnout symptoms (Secondary outcome) No effect on absenteeism (Secondary outcome)
"Purple Trial"	116 white collar workers with subclinical symptoms (employees from 6 different companies with depressive symptoms not on a sick leave, without a labor dispute with the employer and currently not on mental health medication)	Students providing participcant feedback reviewed by a supervisor	- Randomized controlled trial (RCT) - Web-Based Guided Self-Help Intervention was directed at workers. It contained 6 lessons on problem-solving treatment and cognitive therapy, aimed at reducing depressive symptoms.	Problem-Solving techniques; Provision of information; Provision of personalized feedback to participant	115 workers in Care-as-Usual group (groups at random assignment)	54% (iCBT) and 74% (case-as-usual group)	Computerized intervention is not more or less effective that Care-as-Usual (CAU) approach, but in iCBT the completin rate was substantially lower (54% completion rate in iCBT group and 74% completion rate in case-as-usual group) + Depressive symptoms (Primary outcome) + Anxiety (Primary outcome)		No effect on secondary outcomes: - Burnout - Work performance - Duration of absenteeism
"Dark Blue Trial"	137 healthy white collar workers (office workers at a non-ferrous metal manufacturer in Japan)	Two CBT specialists (one psychiatrist, one psychotherapist), one occupational physician and three occupational health care nurses	- Randomized controlled trial (RCT) - Employee training based on one group session with occupational specialists and three e-mail sessions with occupational health care staff	Provision of information; Provision of peronalized feedback to participant	124 workers (groups at random assignment to the waiting list)	59%	++ Decrease of depressive symptoms (Primary outcome)	No effect on self-esteem (Secondary outcome)	
"Orange Trial"	*13'000 healthy white and blue collar workers (assumingly healthy employees at three manufacturing sites within a single corporation)*	Instructor-generalist	- Cohort (volunteers) - Brief two-session stress management program took place over two week time periods. Content of the stress-management intervention included training in abbreviated progressive relaxation, discussion of time management techniques, and homework assignments for practicing stress reducing activities.	Stress-Management techniques (mini-relaxation based on breathing excercises)	No control group	All participants completed the first session (participants are voluneers only); high droupout rates for the second session of computerized intervention		Immediate improvement of perceived and physiologically measured stress, but no effect after one month	

RESULTS: PROPOSED THEORETICAL PREMISES FOR IDENTIFICATION AND EXPLANATION OF DEMI-PATTERNS

Key characteristics of Training and Development include:
1) Types of training content (Armstrong and Taylor, 2017)
2) Training delivery methods (Armstrong and Taylor, 2017; Zuboff, 1988)
3) Workplace learning characteristics (Stern and Sommerlad, 1999)

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RESULTS: 1) TRAINING CONTENT

Training and Development represent Human Resource practice (HR practice) supporting business processes in an organizations (Armstrong and Taylor, 2017).

1) **Training types according to the content** (Armstrong and Taylor, 2017) include:

- Occupational safety,
- technical,
- technology,
- quality,
- professional skills,
- soft skills, team, and managerial training.

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RESULTS: 2) DELIVERY METHOD

2. **Training and development delivery methods** (Armstrong and Taylor, 2017; Zuboff, 1988) include:

a. Traditional learning: on-the-job training; mentoring, courses, etc.

b. Electronic learning (**e-learning**):

- **e-learning practices such as computer-based training**, virtual classrooms, digital collaborators, blended learning and knowledge database access (Brown and Charlier, 2013; Stone et al., 2015).

  Computer-based training includes web-based training (WBT) is an internet browser-based learning which is also available on local intranet. WBT technologies include streaming audio/video, webinars, forums and instant messaging.

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RESULTS: 2) DELIVERY METHOD

The e-learning activities belong to relational electronic Human Resource practices (eHR practices) in Training and Development.

They support business processes in **electronic Human Resource Management (eHRM)** (Obeidat, 2016; Strohmeier, 2009) that links Information Technology and Human Resource Management.
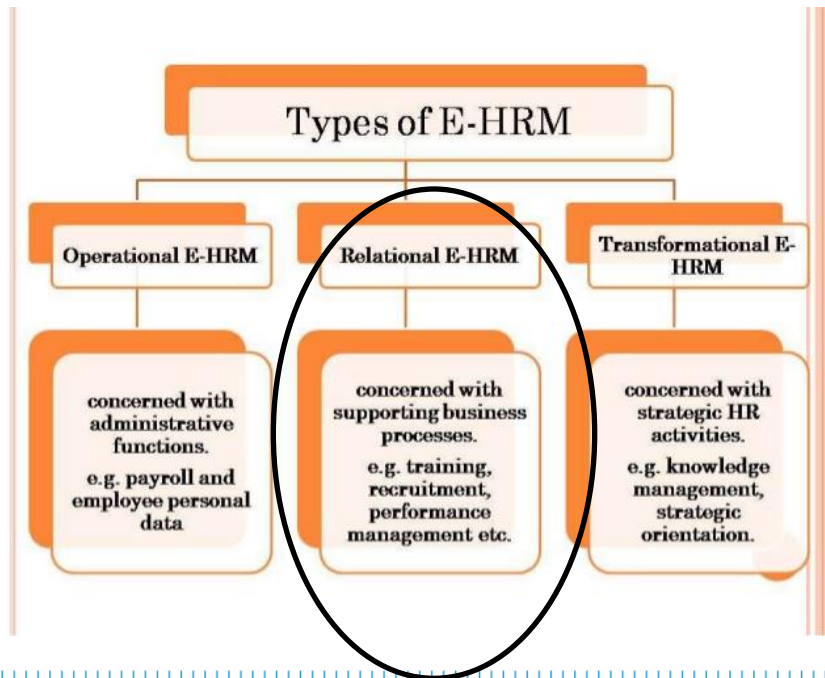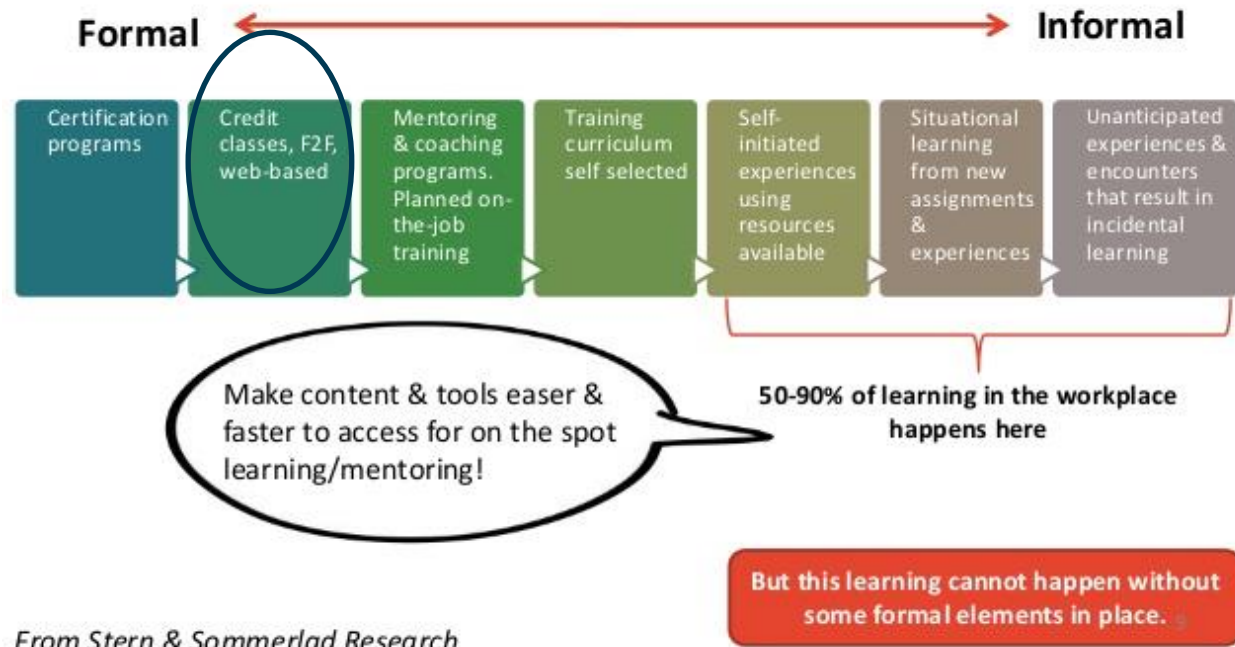
RESULTS: 3) WORKPLACE LEARNING CHARACTERISTICS

- Workplace learning is largely experiential and social process (Armstrong and Taylor, 2017; Stern and Sommerlad, 1999; Zuboff, 1988)

- Workplace plays an important role in formal and informal learning (Stern and Sommerlad, 1999)

Learning Spectrum

If you're looking for examples between the formal & informal:

Formal ←——————————————————→ Informal

| Certification programs | Credit classes, F2F, web-based | Mentoring & coaching programs. Planned on-the-job training | Training curriculum self selected | Self-initiated experiences using resources available | Situational learning from new assignments & experiences | Unanticipated experiences & encounters that result in incidental learning |

Make content & tools easer & faster to access for on the spot learning/mentoring!

50-90% of learning in the workplace happens here

But this learning cannot happen without some formal elements in place.

From Stern & Sommerlad Research

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RESULTS: 3) WORKPLACE LEARNING CHARACTERISTICS

- The most effective and extensive learning occurs through the full mix of learning and everyday work routine, which means that workers mainly learn from coworkers and their own experience (Stern and Sommerlad, 1999; Reynolds, 2004, p. 3).

- Four types of formal learning practices account for less than 10%-50% of learning in the workplace.

- **Computerized learning practices, including web-based learning practices, are the second most formal and least effective learning practices.**

RESULTS: 3) WORKPLACE LEARNING CHARACTERISTICS

Workplace learning characteristics: There are three types of workplace learning according to its characteristics (Stern and Sommerlad, 1999):

1. **Site for learning:** learning location, "training island" separated from daily operations

2. **Learning environment (work-related learning):** focused on the organizational context and social interactions, including different more or less structured on-the-job activities, such as mentoring, or cross-site project work.

3. **Mix of both types (work-related learning in the workplace).**

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RESULTS: REALIST SYNTHESIS

Intervention characteristics		Workplace role in computerized interventions for mental health enhancement on the iCBT example		
Characteristics of workplace learning by Stern and Sommerlad (1999) Description resulting from the realist synthesis:		Workplace as a site for learning	Workplace as a learning environment	Mix of learning and everyday work routine in the workplace
Training type		Problem-Solving skills; Behavioural skills	Knowledge; Behavioural skills; Ability to assess risks/goals	Computerized interventions for mental health improvement are not applicable due to their formal character.
Participants (P)		Any worker in an organization	Specific employee groups	
Internvention (I)	Interventionnalists	Mainly generalists	Mainly specialists in occupational and mental health	
	Intervention design	- Standardized intervention design across different organizations and their work sites - Use of algorithm-based applications for behavioral skill develompent	Alignment of intervention design with a specific organizational context - Use of algorithm-based applications for training focused on mental health knowledge and behavioral skills development	
	Treatment strategies	Skill-building techniques	Provision of information; skill-building techniques	
Comparison group (C)		General working population	Workers in an organization	
Outcome (O): achievement through computerized interventions for mental health	Depressive symptoms	Yes	Yes	
	Other mental health-related symptoms	Yes	Yes	
	Work-related outcomes	No	Yes	

Table 3 Realist synthesis results presented according to the PICO method.

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RESULTS: DEMI-REGULARITIES AND MECHANISMS OF ACTION

- According to their content, interventions focus on **occupational health and safety.**

- They aim to achieve **mental health-related and work-related outcomes** with different effectiveness.

- **Roles of algorithm-based applications in the iCBT interventions may vary substantially** from communication during the participant recruitment to providing information and feedback to participants with different personalization degree.

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RESULTS: DEMI-REGULARITIES AND MECHANISMS OF ACTION

- Accordingly, the factors and mechanisms in computerized interventions formed demi-patterns with different logics.

- Theory explaining the role of algorithms in computerized interventions for workplace well-being enhancement expands the theoretical explanations regarding:
  - different roles of the workplace in learning characteristics in an organization (Stern and Sommerlad, 1999)
  - and in psychosocial interventions (Schulz et al., 2010) (Table 3).

RESULTS: PROPOSED THEORETICAL EXPLANATION

- There are **two distinct strategic approaches** to the use of algorithm-based applications for workplace well-being enhancement, according to which the workplace may represent:

    1. **Either an organizational context (workplace as learning environment),**
    2. **Or a location (a site for learning) of the computerized interventions.**

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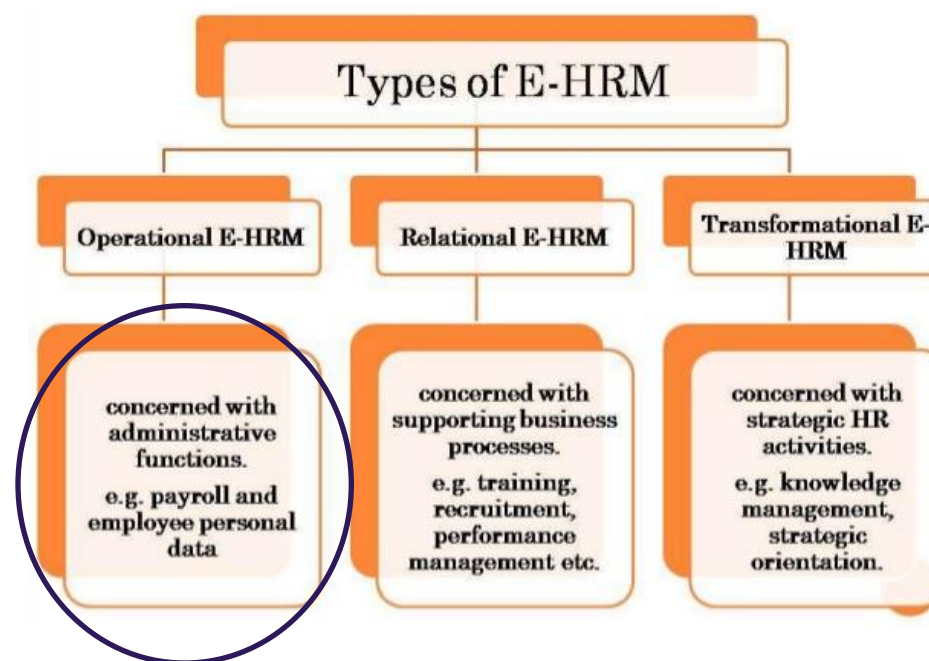
RESULTS: PROPOSED THEORETICAL EXPLANATION

1. When the workplace is a **site for learning**, then the employers are likely to use algorithm-based applications for :
   1. **alignment of communication** with participants to a specific organizational context,
   2. **providing information** specific to the participating employee cohort,
   3. development of **knowledge related to well-being enhancement** and behavioral skills.

2. When the workplace is a **learning environment**, then the employers are likely to use algorithm-based applications for:
   1. **administrative contact** with participants
   2. and **behavioral skills development** without providing information or knowledge related to the workplace well-being.

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RESULTS: EXAMPLE OF A WORKPLACE AS A SITE FOR LEARNING

- **Participants:** In "Orange Trial", 13'000 white and blue collar workers participants are assumingly healthy employees at 3 manufacturing sites within a single corporation.

- **Intervention based on "Mindfulness":**
  - It used The Abbreviated Progressive Relaxation Training, which is one of the most widely used methods for reducing stress in various demographic groups.
  - The intervention implementation included content delivery through two brief Web-based stress management sessions followed by a two-minute mini-relaxation, based on deep breathing, mindfulness techniques, and muscle tension relaxation.
  - Instructors with generalist profile have delivered an intervention.
  - **The use of computerized applications** has affected the **contact mode** and **intervention implementation**. The contact mode included the use of electronic advertisements to recruit participants. Then, participants completed all measurements electronically, and they had the option of returning the surveys via electronic or inter-office mail.

- **Comparison: In-person and wait-list control group**

- **Outcome: Efficient for immediate stress reduction indices; ineffective after 1 month of intervention and in long term; high level of program droup-outs, especially in computer-presentation format**

RESULTS: PROPOSED THEORETICAL EXPLANATION

Types of E-HRM

Operational E-HRM — concerned with administrative functions. e.g. payroll and employee personal data

Relational E-HRM — concerned with supporting business processes. e.g. training, recruitment, performance management etc.

Transformational E-HRM — concerned with strategic HR activities. e.g. knowledge management, strategic orientation.

- **Algorithm-based applications mainly play the role of IT tools in Operational eHR practices** concerned with administrative functions, such as contacting the participants, when the **workplace** represents an **intervention location**.

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RESULTS: EXAMPLE OF A WORKPLACE AS A LEARNING ENVIRONMENT

- **Participants:** In "Tan Trial", participants are 381 healthy white collar workers in two information technology companies in Japan. **Having access to the Internet** via a PC at home or at the workplace was an explicit study inclusion criteria.

- **Intervention:**
  - Organization provided an internal employee assistance program service regularly prior to the computerized intervention. The trial was also adapted to the national context. Participants had access to a web-based training course program in stress management skills, taking form of a Japanese Manga comic story.
  - The course comprised **weekly 30-minute training sessions in an e-learning program for stress management** that lasted 6 weeks.
  - **Algorithm-based application were used for contact** (email reminder to complete a lesson and/or to submit a homework assignment); **treatment implementation** (Web-based treatment delivery and measurements Web-based self-report questionnaire)
  - Mainly specialists delivered the intervention; optional feedback through Web possibly provided by a non-specialist under supervision of specialists

- **Comparison: In-person and wait-list control group**

- **Outcome: the iCBT was effective in decreasing depressive symptoms and increasing work engagement, thought it had a small effect size. However, the iCBT did not improve work performance.**

RESULTS: PROPOSED THEORETICAL EXPLANATION
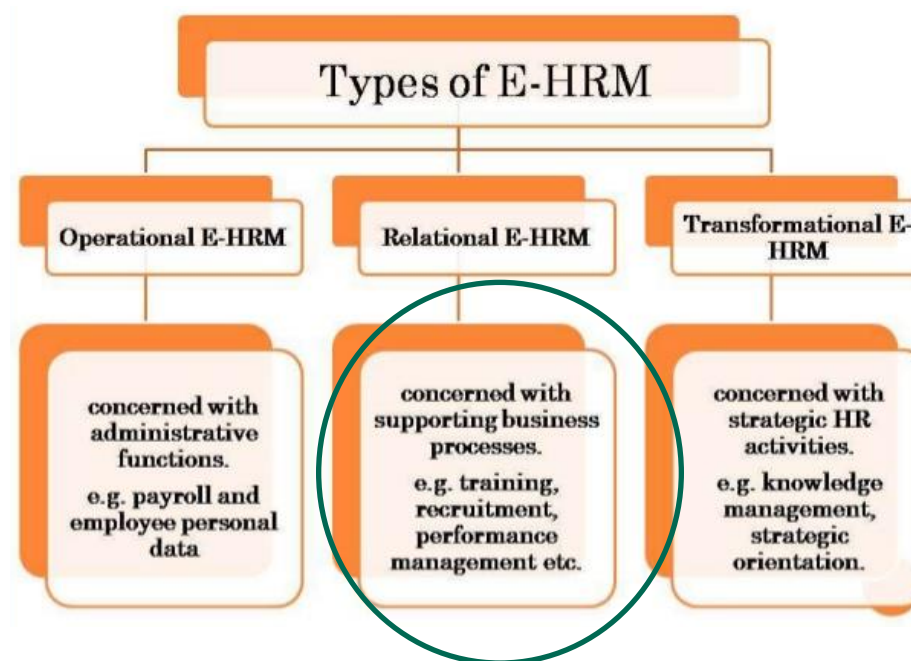
- **Algorithm-based applications mainly play the role of IT tools in Relational eHR practices** concerned with support business processes, such as Training for Occupational Health and Safety through iCBT, when the **workplace** represents an **organizational context of an intervention.**

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RESULTS: DISCUSSION

- This narrative literature review of seven primary studies shows that the **algorithm-based applications play different roles in interventions for workplace well-being enhancement, when the workplace represents:**
  - **a learning location or**
  - **a learning environment**.

- Algorithm-based applications represent IT tools in **Operational and Relational electronic Human Resource practices (e-HR practices)** for the workplace well-being enhancement.

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RESULTS: DISCUSSION

- **The use of algorithm-based applications cannot replace traditional approaches to workplace well-being, they may only support them**.

- The e-training, as other e-HR practices, is more likely to be efficient, when it is **aligned with the other HR practices and HR configurations for different employee cohorts** (Lepak and Snell, 1999; Wright and Snell, 1998).

- **Decision to use algorithm-based intervention tools should fit with other intervention design characteristics**, HR goals, HR management practices related to occupational health and unique organizational context.

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CONCLUSION

- **Algorithm-based training and development for workplace well-being enhancement are conceptualized as a new electronic Human Resource practice (e-HR practice), involving both HR and information technology.**

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PRACTICAL IMPLICATION

- Organizations may enhance employee well-being by using computerized interventions as e-HR practices for Training and Development on occupational health and safety.

LIMITATIONS

- Very little information was provided about the theoretical framework, intervention goals, alignment with strategic HR and business objectives, if any.

- Only 7 computerized interventions reviewed

- Theorizing based on one intervention component (algorithm-based applications in computerized interventions) aspect that does not account for relationship with other occupational health, safety or HR practices.

FUTURE RESEARCH

- Further empirical experimental studies

- Advance theoretical understanding of the impact of computerized interventions with e-training components on well-being and work-related outcomes

- Effectiveness of computerized interventions, compared to the use of other methodologies

- The impact of computerized interventions on other workplace well-being outcomes:
  - ❖ social well-being;
  - ❖ physical and physiological health

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THANK YOU! ANY QUESTIONS?

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