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Behaviour Based Safety (BBS) - Advantages and Criticism

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Abstract

Behaviour-Based Safety (BBS) is a popular approach to enhancing occupational safety, with many researchers reporting successes of implementing BBS programs. There are, however, studies that see this approach as illusory, bringing more harm than good. The first goal of this article is to present an overview of literature providing both evidence and elaboration of implementing BBS programs, highlighting both positive and negative views of the approach. The second goal is to discuss the perception of the method, based on a literature review and authors' own research.

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1. Introduction

The importance of occupational health and safety in organizations is highlighted with relevant statistics in introductions to almost every book and research paper on this topic. The perception and approach to safety, however, has greatly changed with time (for a thorough historical analysis see (Swuste et al., 2010, Swuste et al. 2014)). In the early industrial era, accidents were attributed to fate or other uncontrolled force, and seen as unavoidable. For some time, they were attributed to "accident proneness", a personality trait of workers who tend to have accidents more often than others (Kerr, 1957, as cited in McAfee and Winn, 1989). Later, accidents were linked to flaws in mechanical or environmental design (Greene 1969, as cited in Sulzer-Azaroff, 1978). More recently, accidents tend to be seen as combination of those two factors, a result of interaction between the worker and the environment. The cause of accidents is still an important question. Behaviour-Based Safety, or BBS, is a popular approach to safety management, that sees the main cause of accidents in unsafe behavior. The seemingly solid theoretical background and widely reported effectiveness make BBS programs quite appealing, as it is shown by the authors' own research. BBS programs, however, are subject to criticism, which should be taken into account before their implementation.

2. Literature study

Unlike many management methods or techniques, it is hard to track down the exact moment of emergence of BBS, or to name the "pioneer" or "inventor"; some of the earliest implementations, however, can be found in the late 70s. of the twentieth century (Sulzer-Azaroff, 1978; Smith, Anger,

Uslan, 1978). BBS can be defined as "a set of techniques aimed to encourage or discourage employees from particular behaviour to prevent workplace accidents and illnesses. The implementation of such a program requires setting its goals, establishing observation techniques, recording and analyzing the causes of workers unsafe behaviour and creating an effective communication system" (Peçilło, 2010). Or, simply, "BBS focuses on what people do, analyzes why they do it, and then applies a research-supported intervention strategy to improve what people do" (Geller, 2001). The roots of the BBS methodology can be linked to the works of Heinrich (1927, 1928, 1929, 1931, 1941, as cited by Swuste, van Gulijk, Zwaard, 2010; Heinrich 1959 as cited by Choudry, 2014), who claimed that around 88% of industrial accidents are caused by worker's unsafe behaviour. Another equally significant background is Skinner's (1938, 1953, 1974, as cited by Geller, 2001) research on applied behaviour, which assumes an antecedent-behavior-consequence (ABC) model. Antecedents work as "triggers" of behaviour, while the consequences – positive or negative – determine the probability of repeating the behaviour in the future. The weight of the consequences is yet another issue, as immediate or high-probability outcomes may outweigh long term or low-probability outcomes, e.g. not wearing personal protective equipment (PPE), while may cause some risk of injury and/or illness in the long run (such as loss of sight/hearing or lung problems) gives immediate and highly probable positive outcome in form of increased comfort, better movement speed, or social acceptance of other workers (Gniazdowski, Sibiński, 1999; Zohar, Erev, 2007). Therefore, providing workers with positive consequences – rewards (positive reinforcement) may enhance the probability of the desired behaviours, while providing penalties (negative reinforce-

ment) can discourage them from the undesired, risky ones. The rewards and penalties may take different forms, from positive or negative feedback, through celebrations and parties for reaching set goals, to financial incentives and even lay-offs.

The actual course of action while implementing a BBS program varies, depending on the author and in particular reported cases. However, it can be summed up to a few main steps. Geller provides an approach dubbed “DO IT” for BBS programs (similar to Deming’s PDCA cycle) which consists of four steps: 1) Define – behavior(s) to target, 2) Observe – to collect baseline data, 3) Intervene – to influence target behavior(s), 3) Test – to measure impact of intervention. In a similar fashion, McSween (2003) lists that a successful BBS process (as he argues that ensuring safety should be an ongoing process, not a program) should consist of four basic components: 1) a behavioural observation and feedback process, 2) formal review of observation data, 3) improvement goals, 4) reinforcement for improvement and goal attainment (Geller, 2001; Geller, 2005).

Many literature reviews reported an extraordinary success of implementing BBS in different countries and industries in analyzed papers, for example: McAfee and Winn (1989) – 24 papers, Sulzer-Azaroff and Austin (2000) – 32/33 papers Peçiřlo (2010) – at least 8 papers judging from the provided bibliography (particular authors’ overall work is generally discussed in the article). The “success” of BBS programs can be defined in many ways, as different measures and rates are used by researchers; the list of reported positive effects includes (but is not limited to): decrease in the number of unsafe behaviours, decrease in the number of injuries/injury rates (e.g. per 100 workers) and illnesses, decrease of absence from work caused by injuries and illnesses, lower costs of treatment, lower insurance rates, increase in the number of “safety behaviour” (behaviour increasing safety of the workplace), more worker involvement in contribution to organizational safety, overall improvement of organization’s *safety climate* and/or *safety culture*. *Safety climate* is a term reflecting the overall level of safety in the organization. It was coined and developed by Zohar (1980), and initially included “workers’ perceptions of management attitudes about safety and their perceptions regarding the relevance of safety in general production processes” (p. 96). *Safety culture* is considered a part of organizational culture, consisting of employee attitudes towards safety, common norms of safety behaviour, values assigned to safety (Studencki, 1996, as cited by Znajmiecka-Sikora, 2012).

BBS programs, however, are subject to criticism. (DeJoy, 2005) lists three most popular arguments against BBS, i.e.: 1) “victim blaming”, 2) minimizing the importance of the environment, and 3) focus on the immediate causes. The arguments are actually strongly interconnected; “victim blaming” or “blaming the worker” is the practice of placing all the responsibility for accidents on individual workers (excluding any responsibility of the management), who are expected to work safely all the time, no matter what the conditions are, even if the working environment is not controlled to ensure safety. Such behaviours are seen as immediate cause of the accidents, and no attention is given to previous steps of the causal change, i.e. what the reason of such behaviour was. This interconnection can be seen in (Peçiřlo

2010), as she reveals that “[victim blaming] argument [against BBS] is justified if those programs are not based on finding the cause of unsafe behaviour”. Ironically, among examples of unsafe behaviors listed in the same article, we can find: using wrong tools for the job, using tools in a bad condition, without valid inspection certificates, without or with damaged covers and protective gear, using damaged PPE or not using it at all. While a possible fault of the worker cannot be excluded (e.g. laziness, carelessness), one must agree that supplying the right tools and equipment and ensuring its proper condition should be the responsibility of the employer, rather than the worker.

SMITH (1999) as well as Frederick and Lessin (2000) raise many similar arguments against BBS. As they reveal, the “victim blaming” tendency in BBS comes directly from the aforementioned statistic made by Heinrich in the 1930s, which, despite its age, are commonly accepted and cited to this day (see McSween, 2003; Peçiřlo, 2011, Chen, Tian 2012; Zhang, Fang, 2013; Choudry, 2014, among others). Heinrich was in fact an insurance investigator, and his conclusions probably lack any scientific proof (Smith, 1999), as he based his data on supervisor reports, which naturally put the blame on the workers (Frederick, Lessin, 2000). Both articles also highlight the limitations of applied behaviourism as the basis of BBS, as many experiments prove that incentives may not always work as expected, or even bring an adverse effect, mostly referring to Kohn’s *Punished by rewards* book (1993, as cited by Smith, 1999). They also both point out that instead of contributing the *safety climate* or *culture*, BBS programs actually create the climate of fear. Smith argues that being observed during work can be more stressful than working in normal conditions (and in fact cause more unsafe behaviours). Frederick and Lessin suggest BBS cause reluctance to report injuries (to avoid the label of “unsafe worker”), giving example of one factory, where half of the workers raised their hand when asked if they are afraid to report injuries; an anonymous survey later showed that another 20% were even afraid to raise their hand in public. Smith claims that BBS programs tend to bring only short-term effects (an issue raised already in 1989 by McAfee and Winn), as they focus solely on the results, giving the false assumption that the real problems were solved; Frederick and Lessin claim the only point of BBS programs is to discourage workers from reporting injuries, as it is more profitable for the employer. Finally, both articles highlight that BBS programs are disapproved of by worker unions; Frederick and Lessin also mention the disapproval of Occupational Safety and Health Administration (OSHA).

Brown and Barab (2007) presented a thorough case study of the San Francisco Bay Bridge rebuild project, which proved how BBS programs can result in injury and illness rate manipulation. The BBS strategy held by the consortium behind the project provided all working crews with substantial monetary incentives, while foremen, supervisors and managers of different levels were additionally rewarded with “merit cards” required for career advancement. All rewards were distributed only if no injuries were reported in a given period. The BBS program created an atmosphere of fear, as any injury report of an individual worker would result not only in losing his or her reward, but also rewards of other team members and of its superiors. There were many signs of

workplace harassment, and even a suspicion that the physicians caring for the workers were manipulated to understate the injuries, so there was no need to report them and victims could return to duty. The California Division of OSHA filed a citation against the consortium, as it intentionally did not file at least 13 worker injury reports. According to the OSHA this was not an individual case, as similar problems were found even in several Fortune 500 companies.

3. Results of own research

The BBS approach was discussed in the form of a guided interview with a group of occupational safety experts (n=11), chosen on a criterion of having either professional experience as occupational safety inspectors, experience as a academic lecturer focused on OHS, or a combination of both. Additionally, similar discussion was held with a group of working students (n=60). In both cases the discussions consisted of the following parts: 1) brief presentation of the BBS approach foundations and rules, 2) general questions about the perceived usefulness of implementing BBS programs in Poland (“do you think such programs in Polish enterprises are worth implementing?”), 3) questions about the perceived potential benefits of implementing BBS programs (see Fig. 1), 4) questions about the perceived potential barriers in implementing BBS programs (Fig. 2).

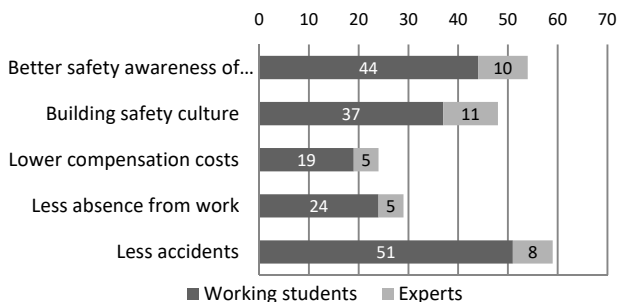


Fig. 1. Perceived benefits of BBS programs

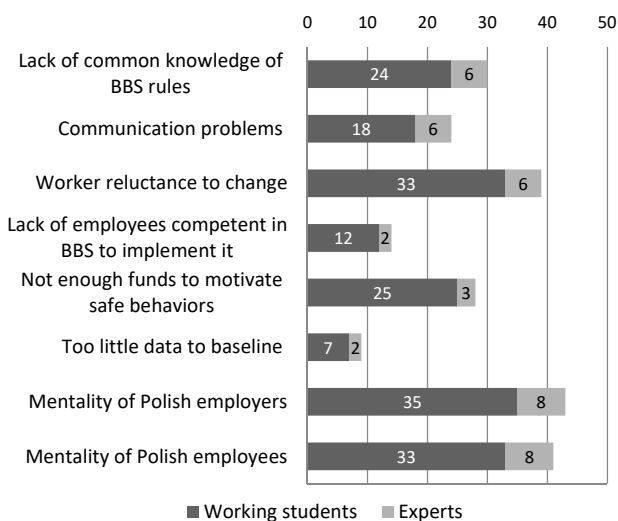


Fig. 2. Perceived barriers of BBS program implementation

The results were quite similar for both groups. Among the benefits, the experts unanimously pointed out the ability to build safety culture (probably due to a good theoretical background and the importance of the matter highlighted in literature); “better safety awareness of workers” was the second most popular answer and “less accidents” was the third; these answers were also the most popular among the working students, but in an exactly reverse order. The influence of BBS programs on absence from work and compensation costs were also popular answers in both groups. Single experts also pointed out the possibility of influence of one worker on another toward safe behaviours and lower insurance rates, while one student also listed lower overall costs generated by the accidents (including potential damage to equipment). As for the barriers, the mentality of both employers and employees in Poland was the most popular answer among both experts and students, the latter also listed “reluctance to change” among the workers as equally strong barrier. While the factor was equally important among the experts as “lack of common knowledge of BBS rules and “communication problems” in enterprises (listed by 6 respondents), the last two were slightly less important to students, which, on the other hand, numerous listed the lack of funds to motivate safe behaviours as a major issue, listed by only three experts.

While motivational incentives varied greatly in the literature and could be both simple verbal feedback as well as monetary rewards, the latter seem to be more convincing to the working students. Only one working student additionally raised the issue of the difficulty in defining clearly the “unsafe” behaviours, as well as the possibly negative and hostile attitudes towards persons observing and reporting them (who can be seen as “squealers”). As for the general question of BBS usefulness, all experts perceived the approach as useful, and only 4 working students had negative attitude towards it. Although they did not list more barriers in its implementation than the average in the group, those barriers had to feel significant, as they perceived the approach as a “waste of time and money” and seen “no point in its [the BBS program] implementation”.

4. Discussion

Although almost every respondent saw many potential barriers in implementing BBS programs, they were mainly connected to organizational aspects (most importantly the “fear of change”), none of them actually came to conclusions raised by the critics of the approach, with only one person raising the issue of “unsafe” behaviour definition. It is worth noting, that only the basic aims and rules of BBS were presented to the research participants at the beginning of the interview; they were not informed about its advantages, actual results of implementation (positive, negative or neutral) nor the criticism of the approach in any way, aside their own prior knowledge.

Despite the relatively small sample size, the study shows that the core ideas behind the BBS approach are generally attractive to workers and (perhaps even more) to safety experts. The “charm” of the behavior change programs also tends to affect the academics; together with the sheer volume of reported positive results of BBS programs, it overshadows the criticism and its supporting evidence, as a good number

of researchers in recent years implemented BBS programs with some degree of success (see e.g. Peçiĥo, 2011; Chen, Tian, 2012; Boczkowska, Znajmiecka-Sikora, 2014; Choudry, 2014).

While the behavioural aspects of safety are still important in recent studies, more attention is given to the environmental and managerial aspects that may lead to unsafe behavior, building upon Zohar's (1980) safety climate. A popular method to model these relations is structural equation modeling (SEM). For example, Fogarty and Shaw (2010) provide a model in which *management attitude* and *pressure* may lead to safety violations. According to (Vidnokumar, Bhasi, 2010), behaviours (*safety compliance* and *safety participation*) are influenced by safety management practices (*management commitment, safety training, workers' involvement in safety, communication and feedback, rules and procedures, safety promotion policies*) directly and indirectly, mediated by *personal knowledge* and *motivation towards safety*. Model by (Seo et al., 2015) shows that safety climate (expressed by *managerial priority, safety communication, safety regulation and safety education*) has the biggest direct effect on safety behaviour; a similar model is presented by (Liu et al., 2015), though they see safety climate as a combination of *management commitment, safety supervision, coworker support and safety training*, and safety behaviours as *PPE use, safety initiatives and safety compliance*. In the model by (Guo, Yiu, Gonzalez, 2016), *safety participation and compliance* is influenced by *safety motivation and knowledge, social support* (similar to *coworker support*), *production pressure*, with *management safety commitment* as a basic factor. Even though the constructs used in those models vary, every model presents the fact that behaviours are very complex, and influenced by many different factors, not entirely dependent on the workers themselves. While the implementation of BBS programs may prove successful, this fact is often overlooked, and too much focus on results, instead of their causes, may in the end bring more harm than good to the safety culture of the organization.

References

- Boczkowska, K., Znajmiecka-Sikora, M., 2014. *Behavior-Based Safety – successful metod of building safety culture of the organization*, Marketing i rynek, 5, 766-771, (in: Polish).
- Brown G.D., Barab J. 2007. "Cooking The Books" *Behavior-Based Safety At The San Francisco Bay Bridge*, New Solutions, 17(4), 311-324
- Chen D., Tian H. 2012. *Behavior Based Safety for Accidents Prevention and Positive Study in China Construction Project*, Procedia Engineering, 43, 528-534.
- Choudry R.M. 2014. *Behavior-based safety on construction sites: A case study*, Accident Analysis and Prevention, 70, 14-23.
- DeJoy D. 2005. *Behavior change versus culture change: Divergent approaches to managing workplace safety*, Safety Science, 43, 105-129.
- Fogarty G.J., Shaw A. 2010. *Safety climate and the Theory of Planned Behavior: Towards the prediction of unsafe behavior*, Accident Analysis and Prevention, 42, 1455-1459.
- Frederick J., Lessin N. 2000. *Blame The Worker: The Rise of Behavioral-Based Safety Programs*, The Multinational Monitor, 21(11), 10-17.
- Geller E.S. 2001. *Behavior-based safety in industry: Realizing the large-scale potential of psychology to promote human welfare*, Applied & Preventive Psychology, 10, 87-105.
- Geller E.S. 2005. *Behavior-Based Safety and Occupational Risk Management*, Behavior Modification, 29 (3) (May), 539-561.
- Guo B.H.W., Yiu T.W., González V.A. 2016. *Predicting safety behavior in the construction industry: Development and test of an integrative model*, Safety Science, 84, 1-11.
- Liu X., Huang G., Huang H., Wang S., Xiao Y., Chen W. 2015. *Safety climate, safety behavior, and worker injuries in the Chinese manufacturing industry*, Safety Science, 78, 173-178.
- McAfee R.B., Winn A.R. 1989. *The Use of Incentives/Feedback to Enhance Work Place Safety: A Critique of the Literature*, Journal of Safety Research, 20, 7-19.
- Peçiĥo M. 2010. *Effectiveness of unsafe behavior modification programs – experiences of foreign enterprises*, Bezpieczeństwo Pracy: nauka i praktyka, 11, 16-19 (in: Polish).
- Peçiĥo M. 2011. *Unsafe behavior modification programs – results of implementation in chosen Polish enterprises*, Bezpieczeństwo Pracy: nauka i praktyka, 5, 9-11 (in: Polish).
- Seo H.-C., Lee Y.-S., Kim J.-J., Jee N.-Y. 2015. *Analyzing safety behaviors of temporary construction workers using structural equation modeling*, Safety Science, 77, 160-168.
- Smith M. J., Anger W. K., Uslan S. S. 1978. *Behavioral modification applied to occupational safety*. Journal of Safety Research, 10(2), 87-88.
- Smith T.A. 1999. *What's wrong with behavior-based safety?*, Professional Safety, 44 (9), 37-40.
- Sulzer-Azaroff B. 1978. *Behavioral Ecology And Accident Prevention*, Journal of Organizational Behavior Management, 2 (1), 11-44.
- Sulzer-Azaroff B., Austin J. 2000. *Does BBS Work? Behavior-Based Safety & Injury Reduction: A Survey Of The Evidence*, Professional Safety, 45(7), 19-24.
- Swuste P., van Gulijk C., Zwaard W. 2010. *Safety metaphors and theories, a review of the occupational safety literature of the US, UK and The Netherlands, till the first part of the 20th century*, Safety Science, 48, 1000-1018.
- Swuste P., van Gulijk C., Zwaard W., Oostendorp Y. 2014. *Occupational safety theories, models and metaphors in the three decades since World War II, in the United States, Britain and the Netherlands: A literature review*, Safety Science, 62, 16-27.
- Vinodkumar M.N., Bhasi M. 2010. *Safety management practices and safety behaviour: Assessing the mediating role of safety knowledge and motivation*, Accident Analysis and Prevention, 42, 2082-2093.
- Zohar D. 1980. *Safety Climate in Industrial Organizations: Theoretical and Applied Implications*, Journal of Applied Psychology, 65 (1), 96-102.
- Zohar D., Erev I. 2007. *On the difficulty of promoting workers' safety behaviour: Overcoming the under-weighting of routine risks*, International Journal of Risk Assessment and Management, 7(2) (January), 122-136.

基于行为的安全（BBS） – 优势与批判

關鍵詞

行为
安全
事故

摘要

基于行为的安全（BBS）是一种增强职业安全的流行方法，许多研究人员报告了实施BBS计划的成功经验。然而，有研究认为这种方法是虚幻的，带来的弊大于利。本文的第一个目标是提供文献概述，提供实施BBS计划的证据和详细说明，突出该方法的积极和消极观点。第二个目标是基于文献综述和作者自己的研究来讨论对该方法的看法。
