SERIOUS GAMES FOR VOCATIONAL EDUCATION AND TRAINING

REVIEW OF CLASSIFICATIONS OF OCCUPATIONS

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ABSTRACT

This paper presents an in-depth analysis and discussion based on a systematic review of different national and international classification systems of occupations. From the educational perspective, it is our goal to develop a concept for the recommendation of relevant educational games. Therefore, a systematic literature review has been undertaken to identify fitting criteria and databases to identify and provide appropriate serious games / educational games in vocational education and training. Within the research project "Serious Games for Vocational Education and Training" (SG4BB) funded by the German Ministry for Science and Education, the Serious Games-Information Center (SG-IC, a classical web-based information system in form of a portal) and its underlying Serious Games Metadata Format (SG-MDF, DIN SPEC 91380), as semantic basis for the description and retrieval of serious games, is enhanced according to the characteristics and needs in the field of vocational education and training (VET). Educational stakeholders can use the search engine to search for personalized game-based learning opportunities for their individual target groups. Hereto serious games / educational games are matched with a database of a classification system of occupational fields as defined by the Federal Institute for Vocational Education and Training (BIBB), and main activity as defined by the microcensus, the largest annual household survey of official statistics in Germany.

INTRODUCTION

Occupations or jobs are an important indicator in social and economic research to investigate the labor market and employment in Germany (cf. Federal Employment Agency [BA] 2020). The main objective of a national standard classification of occupations is the comparability of past, existing and future statistical data, such as occupational information, obtained by means of statistical censuses and surveys. This includes aggregating and classifying the collected data and structure them in defined groups. Therefore, a recognized system is used in order to be able to present and analyze the data in a meaningful way. Such a classification has the advantage of a complete and overlap-free coverage of the observed phenomenon. For example, the labor market is divided into different occupational submarkets, that group together jobs based on their similarity in terms of the task approach. Such a system of structured occupational data provides a detailed overview of comparable data to reflect the diversity of occupations and job tasks. However, it should be noted that job tasks differ between, as well as within, the same occupations (cf. Autor & Handel, 2013). This can also be seen in the PIAAC data (cf. Bonin et al, 2015). Nevertheless, classifications serve to provide a sufficient overview that is as close as possible to reality.

There are different classifications necessary to meet the requirements of all different purposes of statistical work. However, not all requirements can be met equally with one classification. Additionally, classifications should become more and more internationally comparable due to the increasing international integration of national economies and the growing need of current economic data (cf. Destatis, 2008). Therefore, many statistical surveys refer to international classifications or use classifications that are based on international or European-wide specifications, as long as this appears to make sense for the survey (cf. Destatis, 2020).

As classifications should necessarily reflect the reality, they should be regularly reviewed and revised, and may even need to be replaced by new classifications. But this is a problem in case of comparability between long-term analyses and statistics of structural changes. Therefore, a balance must be struck between necessary adjustments to economic developments, societal changes or technical progress and unavoidable breaks in time series or negative effects in the compilation, processing and publication of statistical data.

For this purpose, different systematics and classifications are presented and analyzed to identify a suitable occupational classification for this project.

SYSTEMATIC LITERATURE REVIEW

This section provides a systematic review of established and well-founded national and international classification systems. Most classifications are focused on the German labor market. The research produced a total of four national and one international classification systems (cf. table 1). Due to the small sample as result of the literature search, an in-depth investigation of the classifications was undertaken. Therefore, the analysis is based on the following requirements: it should be a realistic and present representation of the diversity of

occupations and job tasks in Germany, but it should give an adequate synopsis of occupational aggregates, there should be a link to the skill level (i.e. DQR/EQF) and it should be compatible to international or other national classifications. The classifications presented partly build on each other but are often based on different structural principles. In addition, they differ in the underlying definition of occupations and define different criteria for determining the similarity of task-approach or occupations.

CLASSIFICATION	DESCRIPTION
International Standard Classification of Occupations (ISCO-08)(ILO, 2016)	• Four-level hierarchically structured classification with 10 major groups, 43 sub-major groups, 130 minor groups and 436 unit groups. • "Skill level" is the primary dimension used to arrange occupations into major groups, within each major group the dimension „skill specialization " is used to arrange occupations into sub-levels. • Compatibility with the KldB 2010 via correspondence table, however, there are allocation problems, especially at the lowest levels (just approximation). • Internationally comparable occupational data, but no image of the real national labor market in Germany. • The major group level has proved to be not differentiated enough, sub-major group level is already too fine-grained.
German Classification of Occupations 2010 (KldB 2010)(BA, 2020)	• Five-level hierarchically structure classification with 10 occupational areas, 37 occupational main groups, 144 occupational groups, 702 occupational sub-groups, and 1,300 occupational types. • "Occupational / Skill specialization" (activities, knowledge, and skills) is the primary dimension used to arrange occupations on the first four levels of the classification. • The dimension "skill level" is used to arrange occupations on the last level, showing the complexity and range of tasks and duties to be performed in an occupation (similar to the ISCO-08). • The occupational types could be helpful for mappings according to the German or European Qualifications Framework (DQR/EQF), but with 1,300 positions the level is too detailed and fine-grained. • The dimension skill level could provide a starting point to identify occupations or jobs with main activity that are highly susceptible to computerization (those could have a particularly high need for digital and game-based learning opportunities). • Theory-based, uniform, up-to-date, realistic, national classification of occupations. • Comparability to the ISCO-08 and to previous national classifications (KldB 1975-1992) just via correspondence tables. • First level is no real occupational breakdown, but represents a thematic overview, with 37 positions the occupational main groups are already too fine-grained.
Occupational sectors and occupational segments (Matthes et al, 2015)	• Second-level hierarchically structure with 5 occupational sectors and 14 occupational segments. • Based on the second level of the KldB 2010 (aggregation of the 37 occupational main groups). • Using homogeneity analyses, the occupational main groups of the KldB 2010 (digit level 2) were arranged into occupational segments and sectors, on the basis of theoretical similarity of occupations to each other). • Each occupational segment includes a description of the main tasks and duties (not a standardized and verified procedure). • Further allocation dimension: number of employees dominating the labor market • Similar to the occupational field definition developed by the Federal Institute for Vocational Education and Training (BIBB).

Occupational fields of the Federal Institute for Vocational Education and Training (BIBB) (Tiemann, 2018; Tiemann et al, 2008)	• Third-level hierarchically structure with 3 occupational major fields, 12 or rather 20 occupational main fields and 50 occupational fields. • Using an identifier (linking the occupational groups [digit level 3] with the skill level [digit level 5] of the KldB 2010) to aggregate the occupations. • The primary dimension used to arrange occupations into groups is based on the similarity of main activity and industry focus (determined using microcensus and BIBB/BAuA employment survey). • Realistic and current structure: changes in occupations and activities are considered. • Verified, proved, long-term valid structure. • Compatibility with the concepts and occupational information in the KldB 2010; in addition, there is a reference back from the previous version of the occupational field definition in 2008 (that was based on the KldB 1992) to the development of the occupational main groups (digit level 2) in the KldB 2010.
German Classification of Economic Activities 2008 (WZ 2008) (Destatis, 2003, 2008, 2020)	• Multiple-level hierarchically structure with 21 sections, 88 divisions, 272 groups, 615 classes, 839 sub-classes. • The classification is based on the dimension main economic activity and products produced or services rendered by one or more business(es) or enterprises. • No occupational information, but classification based on industry or branch of business. • Can report changes, such as digitalization, in industries and economic structures.

Tab. 1: Overview of established and well-founded national and international classification systems

IN-DEPTH ANALYSIS AND DISCUSSION

As one requirement of the project is a realistic and present representation of the diversity of occupations and job tasks in Germany, the ISCO-08 can rather be excluded. Neither the specific occupational characteristics of the national labor market nor of the education system can be satisfactory mapped with it. This is more important than the criterion of international comparability. In addition, despite the correspondence tables between national and international classification systems, there are problems of assignment. For example, at the lowest level of the KldB 2010 some occupations cannot be assigned to just one specific position of ISCO-08, but to several, since these are just priority changeovers (BA, 2020). This could result in the loss of important job-related information.

INTERNATIONAL STANDARD CLASSIFICATION OF OCCUPATIONS 2008

The International Standard Classification of Occupations, Edition 2008 (ISCO-08) is an instrument developed by the International Labor Office (ILO) for statistical purposes and for internationally comparable research. The aim of the classification is to provide a systematization of occupational activities that serves as a basis for international comparisons, reporting and statistical work. At the same time, it provides a template for regional or national classifications, or an alternative for non-existing national occupational classifications (ILO, 2016). The ISCO-08 is not intended to replace existing national occupational classifications that realistically reflect country-specific labor market structures and occupational data. Rather, by bringing the concepts and

structures of national classifications closer to ISCO-08, it is comparatively easier to break down data on occupations and occupational activities so that they can be compared internationally.

The structure is based on two dimensions, according to which the occupational activities are aggregated into similar categories: "skill level" and "skill specialization". Therefore, it does not classify occupations but activities (jobs) at the skill level into four hierarchical levels: 10 major groups, 43 sub-major groups, 130 minor groups and 436 unit groups. In this way, the degree of complexity of the corresponding occupational activity is mapped according to occupational sociological aspects (professionalization and apprenticeship). The concept of skill level is primary applied at the top (major group) level of the ISCO-08. Further, the dimension "skill specialization" serves as a distinguishing criterion on the other levels.

LEVEL	BREAKDOWN LEVEL	ISCO-08 REVISED VERSION	DIGIT LEVEL	CODE
LEVEL 1	major groups	10	1-digit ISCO-08	0-9
LEVEL 2	sub-major groups	43	2- digit ISCO-08	01-96
LEVEL 3	minor groups	130	3- digit ISCO-08	011-962
LEVEL 4	unit groups	436	4- digit ISCO-08	0110-9629

Tab. 2: Hierarchical structure of the ISCO-08 (cf. ILO, 2010).

Each unit in the hierarchical classification system is given a title, a code number, and a definition that outlines the scope of the group (cf. Tab. 2). The definition summarizes the main tasks and duties of the occupational activities in each group. They also contain a list of sub-groups or, at the lowest level (unit groups), sample occupations.

A significant weakness for a national approach, however, is that the occupation-specific structures of the German labor market, such as the vocational education and training in the dual system or advanced occupational qualifications, cannot be represented well. But it exists a comparability to the German Classification of Occupations 2010 via correspondence table, because the content of the levels is not directly comparable with that of the KldB 2010.

GERMAN CLASSIFICATION OF OCCUPATIONS 2010 (KLDB 2010)

The German classification of occupations 2010 is a theory-based standardized national classification of occupations that was developed in cooperation between expert groups of the Federal Employment Agency. It is a hierarchical structure with five levels: 10 occupational areas, 37 occupational main groups, 144 occupational groups, 702 occupational sub-groups and 1,300 occupational types. At the first four levels, the central dimension used for aggregating occupations is the occupational / skill specialization (in form of tasks, knowledge and skills). On the last level, the dimension is based on the concept of four different levels of requirements, referring as a function of the complexity and range of tasks and duties to be performed in an occupation. Accordingly, the occupational subgroups can be subdivided at the lowest level (5-digit KldB 2010, occupational types) on the basis of the four possible skill levels, insofar as this actually occurs in professional reality in Germany. This is comparable with the dimension "skill level" of the ISCO-08.

The assignment scheme has long-term durability. It is multidimensional in that, it depicts the central occupational areas as clearly as possible and presents a moderate overview. In addition, it meets the quality criteria of classifications, such as homogeneous classification features and uniform degrees of differentiation across all occupations in the clusters. This results in clearly delineated classification units with balanced aggregation levels within the breakdown levels. The classification contains all central characteristics to describe occupations approximately completely and can cover every conceivable activity. It does not remain a "theoretical construct", but is applied in practice uniformly and thus acquires legitimacy (cf. BA, 2020).

LEVEL	BREAKDOWN LEVEL	KLDB 2010 (NUMBER OF BREAKDOWN LEVELS)	REVISED VERSION 2020 (NUMBER OF BREAKDOWN LEVELS)	DIGIT LEVEL
LEVEL 1	Occupational areas	10	10	1-digit KldB 2010
LEVEL 2	Occupational main group	37	37	2-digit KldB 2010
LEVEL 3	Occupational group	144	144	3-digit KldB 2010
LEVEL 4	Occupations sub-group	700	702	4-digit KldB 2010
LEVEL 5	Occupational types	1.286	1.300	5-digit KldB 2010

Tab. 3: Comparison between the first version of the KldB 2010 and the revised version in 2020 (cf. BA, 2020).

The KldB 2010 provides a basis for the comparability of statistics on the labor market or employment (BA, 2020). The national expert database BERUFENET of the German Federal Employment Agency, which is constantly being expanded and works with updated occupational data, was used as a database. It enables a realistic and objectively based depiction of the occupational landscape in Germany and an appropriate representation of occupational structures in statistics and analyses. Further, it remains flexible to integrate new occupations or unknown activities and to delete obsolete ones. In addition, it is compatible with the international classification of occupations (ISCO-08) without ignoring the specifics of the German labor market and education system. To this end, a high degree of compatibility between KldB 2010 and ISCO-08 was already ensured during the development process, as the creation of international comparability of occupational data was a key requirement (cf. BA, 2020).

However, it should be noted that the first level (1-digit KldB 2010) does not reflect the actual occupational segmentation on the German labor market and the second level (2-digit KldB 2010) with 37 occupational main groups is often too detailed for empirical analyses.

NATIONAL OCCUPATIONAL SECTORS AND SEGMENTS

The occupational sectors and occupational segments are based on the KldB 2010. In cooperation between the statistics department of the German Federal Employment Agency (BA) and the Occupational Labor Markets Research Group of the German Institute for Employment Research (IAB) two further classification units were created, which combine the occupational main groups (2-digit) of the KldB 2010 on the basis of the underlying homogeneity analyses using occupational criteria (Matthes et al, 2015).

BREAKDOWN LEVEL	NUMBER OF BREAKDOWN LEVELS	DIGIT LEVEL
Occupational sectors	5	S (1-digit)
Occupational segments	14	S (2-digit)

Tab. 4: Hierarchical structure of the occupational sectors and segments.

For each of the 14 occupational segments, it is disclosed on which basis and on the basis of which considerations the occupational main groups were combined to form an occupational segment and which dominant tasks or occupational activities are characteristic for this segment. In addition, in case of doubt, the

dominant number of employees' subject to social insurance contributions on the labor market is used as a further classification criterion in order to assign the occupational main groups to the occupational segments. This subdivision represents an alternative to the similarly developed occupational field definitions of the BIBB. The difference is that the aggregation here assumes the theoretical similarity of occupations to one another, whereas the BIBB occupational fields focus on the similarity of activities.

The aim was to develop an alternative to the ten occupational areas of the KldB 2010, since these do not show a uniform or comparable level of homogeneity. Thus, they neither correspond to the actual occupational segmentation of the national labor market, nor are they sufficient for scientific analyses. Although the main occupational groups of the KldB 2010 could be used for this purpose, the breakdown of 37 elements is too fine-grained for empirical analyses. by additionally grouping the main occupational groups according to occupational criteria.

The decisive factor for combining occupational main groups into one occupational segment was the degree of internal homogeneity (occupational proximity) between the two elements. At the same time, the requirement was that the occupational segments should be as distinct as possible, which is why external homogeneity was included. If an occupational main group could not be unambiguously assigned to an occupational segment, the occupational group (3-digit) was examined and it was considered which occupational main group dominates the labor market in terms of numbers (cf. Matthes et al, 2015). This can also be seen in the description of the occupational sectors and occupational segments, as well as the central job tasks or occupational activities.

OCCUPATIONAL FIELDS BY BIBB

The occupational field definition of the German Federal Institute for Vocational Education and Training, Edition 2018, is based on the information on occupations contained in the KldB 2010 (Tiemann, 2018). These are used to combine occupations into aggregates with the help of identifiers, which link occupational groups (3-digit KldB 2010) with skill level (5-digit KldB 2010). For occupational groups, main activity and industry focus are determined on the basis of the microcensus and the BIBB/BAuA employment survey, which serve as classification criteria. The aggregation of occupations results in 50 homogeneous occupational field definitions. Those can be further aggregated into 12 or 20 clearly defined occupational main fields and three major occupational fields. It represents an instrument of occupational research and reporting on the basis of which analysis could be carried out that relate to changes in occupations.

	OCCUPATIONAL MAIN FIELD
1	Occupations in production and processing of raw materials
2	Elementary occupations

3	Occupations in metal-processing or electronics
4	Occupations in construction, wood-processing, plastic-processing
5	Manufacturing occupations
6	Occupations in controlling and monitoring machines and technical processes
7	Sales occupations
8	Occupations in commerce and trade
9	Occupations in traffic and logistics
10	Safety and security occupations
11	Occupations in gastronomy
12	Occupations in cleaning services
13	Business related service occupations
14	Occupations in the IT-sector and the natural sciences
15	Occupations in technology
16	Occupations in law and business management
17	Occupations in social sciences, cultural work
18	Medical and non-medical health care occupations
19	Occupations in social work
20	Occupations in teaching

Tab. 5: Occupational main fields defined by the German Federal Institute for Vocational Education and Training, Edition 2018.

The system of the occupational fields has the advantage that changes in occupations and activities can be better mapped. In addition, the development of the occupational main groups (2-digit) in the KldB 2010 is

already based on the previous version of the occupational fields by BIBB.[1] After a thorough review, it was determined that the two occupational field definitions are sufficiently comparable and that their validity remains largely unchanged. This means that breaks in the time series can be minimized in statistical data analysis using the BIBB occupational fields. However, due to the conversion of all occupation-related data from the KldB 1992 to the KldB 2010, the BIBB occupational field definitions may still require review and adjustment in the near future based on the next BIBB/BAuA employment survey.

CLASSIFICATION OF ECONOMIC ACTIVITIES 2008

An alternative perspective on occupational aspects (occupations or occupational groups) is the classification of economic activities (or industry) (WZ 2008). Occupations can also be grouped by industry on the basis of economic activities in order to be able to compare them (cf. Destatis, 2008). The classification was implemented for statistical purposes and has been prepared in close co-operation with data users and data producers in the business and research communities, in administration and society at large. It considers the requirements of the "Statistical Classification of Economic Activities in the European Community" (NACE Rev. 2). The WZ 2008 is used to present information on individual or groups of enterprises or specialized parts of enterprises in a clear and summarized form.

The classification consists of a hierarchical structure with five levels. The first levels are based on the NACE Rev. 2. The lower sub-classes can be used to reflect national structures. The coding follows the system of the European classification of economic activities to designate a certain activity. Here, the first level is labeled by a letter code (cf. Tab. 6). The second level represents the departments and is coded numerically with two digits, with gaps deliberately left to allow new departments to be added. The third and fourth levels (groups and classes) are also numerically encoded. The lowest level contains four-digit numerically coded classes. The last level of classification is a five-digit subclass that is not integrated into the actual WZ coding (cf. Destatis, 2008).

HIERARCHICAL LEVEL	WZ 2008	CODE
SECTIONS	21	A-U
DIVISIONS	88	01-99
GROUPS	272	01.1-99.0

[1] The previous version of the occupational fields definition by BIBB is based on the KldB 1992.

CLASSES	615	01.11-99.00
SUBCLASSES	839	01.11.0-99.00.0

Tab. 6: Hierarchical structure of the Classification of Economic Activities, Edition 2008 (cf. Destatis, 2008).

The classification of economic activities should be clearly distinguished from occupational classification in order to make statements about vocational education and training (cf. Walden, 2007). The main focus of the economic activity and the products manufactured or services provided by a company or group of companies are used as classification criteria. For example, enterprises or establishments are grouped by economic activity (or sector) "that produce similar products or provide similar services in the course of their economic activity" (Destatis, 2020). This allows statistics on production values or production factors (such as labor, operating resources and materials, energy, etc.) used in the value creation process, capital commitment and financial transactions to be depicted (cf. Destatis, 2008). In this context, the analysis of employment focal points by economic sector can provide information on the correlations between employment opportunities in an occupation and one or more economic sectors (cf. Biersack & Parmentier, 2002). Therefore, depending on the question, it can also be advantageous to use the WZ 2008 to show the developments in the industries. In addition to the occupational structure, the economic structure also plays a role, for example, when considering the increasing digitization on regional labor markets (cf. Zika et al, 2018).

DISCUSSION

In comparison, the national classification of occupations, KldB 2010, would be more suitable, as it presents the current occupational structure and realistically reflects developments on the labor market, as well as long-term changes over time. As the KldB 2010 is based on current occupational information from the expert database of the Federal Employment Agency, the classification is characterized by its practical relevance. At the same time, it is linked to ISCO-08 and thus compatible to international classifications, which is another important requirement. Apart from that, the fifth level of the hierarchical structure of the KldB 2010, the dimension skill level , describes the complexity of the (job) tasks to be performed. This metadata could be used to determine the further vocational education and training profile of interested people: potential users could be located at their current qualification level, e.g. by asking for information on the qualification or skill level. The information could then be compared with the levels of the DQR / EQF and assessed. The four defined skill levels are strongly oriented to qualifications, while all formal qualifications of the German education system are assigned to one of the levels of the DQR. On the basis of this, a comparison could be made. This is relevant, because in the SG4BB project, continuing vocational education and training courses are intended to promote the development of skills within occupations or occupational fields, or between them in order to raise the individuals to a higher skill level

on the DQR (at least level 5). This also includes retraining courses that consider future changes in the labor market due to the increasing computerization. However, the fifth level with 1,300 occupational types is definitely too detailed a basis, but it should still be possible to connect to it for the reasons mentioned above. In addition, the skill level could be used to predict, which occupations have a high share of tasks with substitution potential due to computerization (cf. Dengler & Matthes, 2021, 2018, 2015). This could help to identify occupational fields that might have a particularly high need for e.g. digital game-based learning opportunities. In this context, Dengler and Matthes (2015) recommend separating very precisely by occupation and skill level, as the substitution potentials in the different occupational sub-groups and skill levels are very different. Empirical work cannot be reliable enough, as it is often based on the assumption that a specific occupation is described by precisely one definable bundle of tasks, that is unique to that occupational profile (Alda, 2013; Autor & Handel, 2013). However, this contradicts the fact that a variation of tasks is possible within the same occupation, or is reported subjectively. Thus, sometimes very different tasks are performed in a work situation (Autor & Handel, 2013). The reason for this includes the fact that some employees have different preferences and abilities to perform the tasks. This can be traced back to the fact that the chosen employees for one job could have different qualifications (cf. Alda, 2013).

Another difficulty of the KldB 2010 could be the fact that the first hierarchical level, the occupational areas(digit level 1), provide more a thematic overview. Therefore, it is intended to guarantee a user-friendly handling of the classification than to correspond to the realistic occupational breakdown. In contrast, the second level, the occupational main groups (digit level 2) with 37 elements, is too detailed for the purpose of maintaining a moderate overview. In this context, the occupational segments and occupational sectors could be the better choice, as they are based on the KldB 2010, but provide 14 relatively clearly defined occupational aggregates (cf. Dengler & Matthes, 2018; Matthes et al, 2015). In addition, they largely define the dominant tasks and duties performed in the aggregated occupational main groups of the KldB 2010.

Another aspect that can be discussed is the characteristic or dimension by which occupations are arranged into groups in the KldB 2010 compared to the occupational segments and sectors. In the KldB 2010 it is the occupation and not the core task. Thus, primarily the dimension skill specialization (tasks, skills and knowledge characterizing the occupation) is used to structure and aggregate occupations. Assuming that the increasing use of disruptive digital technologies will lead to changes in (core) tasks within occupations and occupational fields in particular, it could be useful to select a classification system that uses the core tasks, for example. Also, with regard to the determination of the continuing vocational education and training profile and the associated self-location of interested people in their occupational field, the fitting criterion could be the core task. In this context, the occupational fields or occupational main fields as defined by the BIBB would be more suitable. Those are also used in particular in the QuBe project of the Federal Institute for Vocational Education and Training (BIBB) and the Institute for Labor Market and Career Research (IAB) to provide a long-term overview of the likely development of labor demand and supply in terms of qualifications and occupations.

Similar to the QuBe project, the SG4BB project will also identify users according to qualifications and occupations in order to locate them in their occupational field. For this purpose, the concept of identifiers is used that link the occupational groups [digit level 3] with the skill level [digit level 5] of the KldB 2010. Based on this concept occupations are aggregated according to their main (job) task. Therefore, the developed occupational fields already reflect skill level, but at the same time offer an acceptable overview with 20 occupational main fields with clearly defined content, and 50 more detailed occupational fields. The dimension used to classify the occupations is based on the main tasks defined by microcensus and BIBB/BAuA employment survey (ETB). Like the occupational segments and sectors, the updated version of the occupational fields is based on the KldB 2010. Also, the microcensus and the ETB now use the KldB 2010, which demonstrates a high compatibility to national and international classifications.

With reference to the previous analyzes and discussion, the classification of the occupational fields (or major occupational fields) as defined by the Federal Institute for Vocational Education and Training (BIBB), and main tasks and duties as defined by the mikrocensus, can be recommended as a result (Tiemann, 2018). Compared to other classifications as the occupational segments, the occupational fields are based on a well-founded development and has been repeatedly empirical tested. In addition to that, the occupational main fields offer greater content-related differentiation in terms of the aggregated occupations. This results from the use of 'identifiers', which are used to aggregate and classify the occupations based on the digit level 3 (occupational groups) in combination with the digit level 5 (skill level) of the KldB 2010, instead of using the occupational main groups (digit level 2). As the occupational fields are based on the KldB 2010, they are highly compatible.

CONCLUSION

Based on the detailed analysis and discussion, the classification of the occupational fields, as defined by the BIBB, can be recommended as a result (Tiemann, 2018). Compared to other classifications, as i.e. the occupational segments, this classification is based on a well-founded development and has been repeatedly empirical tested. The primary dimension used to classify the occupations is based on the similarity of main activity and industry focus, which is determined using the statistical data collected by the annual microcensus and BIBB / BAuA employment survey (ETB). Additionally, the developed occupational fields already reflect skill level, which describes the complexity of the activities to be performed. As the concept of the occupational fields is based on the KldB 2010, they are highly compatible and provide current specific occupational information from the expert database of the Federal Employment Agency. At the same time, the classification offers an acceptable and realistic overview of the national occupational structure of the German labor market, with 20 occupational main fields that present clearly defined content, and 50 more detailed occupational fields. Additionally, there is an international connection to the ISCO-08 and to other national classifications via correspondence tables. Thus, the classification system as defined by the Federal Institute for Vocational Education and Training (BIBB) best meets all requirements.

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