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A content analysis of fingerprint literature for educational curricula

Max M. Houck [a,*], Jessica Boyle [b]

[a] Forensic Science Initiative & Forensic Business Development, West Virginia University, USA
[b] Forensic Science Initiative, West Virginia University, USA

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ABSTRACT

Forensic science is being required to justify and elucidate its scientific foundations. One way of doing this is through academic curricula. For many native forensic sciences, these curricula do not exist. A content analysis of nine major books in fingerprints was conducted to develop a structure for curricula in that field. The results of this study can be used to organize course content and serve as a model for other disciplines with published materials but no coherent or standard curricula.

1. Introduction

Forensic science is a mixture of borrowed and amended sciences, some from traditional academia (such as biology and chemistry) and others developed internally (such as firearms and impression evidence); it also encompasses sciences which bridge between these two. One of these 'bridging' sciences is friction ridge analysis. The study of friction ridges has a long academic history, from Malpighi to Purkinje to Faulds but was codified by Galton's work in his landmark book [1]. The conversion of forensic science over the years from academic endeavor to police application changed the nature of the discipline, however; forensic science drifted away from its open-ended research origins to a structured, standardized technique fit for purpose within the law and its requirements. Unlike the law, science has no interest in the outcomes of its work (or even a requirement for a result at all), is not concerned with answering questions within a specific timeframe, and has a different standard of proof [2]. Such a shift from "open" to "applied" may ossify a science and prevent it from growing, maturing, and improving [3].

Many forensic disciplines now face the challenge of re-creating what constitutes their academic curricular foundations. Modern forensic educational courses cannot be found in the university course catalog under "the Department of Firearms Analysis" or "the School of Questioned Documents." It is up to the profession to extricate its own academic fundamentals from historical and extant procedures, resources, and publications to meet current scientific, academic, and quality standards. This is easier said than done, much like the difference between "learning about" and "learning how": Learning about collecting fingerprints at a crime scene in a classroom is very different than actually collecting them at a disturbing, jostling, busy crime scene, replete with the sights, sounds, and pressures that come with those situations [3]. The goal is, therefore, to incorporate learning *how* into learning *about* thereby validating the lesson plan, process, and execution [4].

2. Consensus curriculum development

Consensus curricula in forensic science have been developed previously through working groups, such as the Technical Working Group on Education and Training in Forensic Science (TWGED) [5] and its two progeny, TWGED—Digital Evidence [6] and TWGED—Forensic Accounting and Fraud Investigation [7]. These projects, while of enormous benefit to the participants, the discipline, and the relevant communities, are expensive and somewhat lengthy. An alternative method, content analysis, was attempted in the current work for topics where a plurality of publications is available but no standardized curricula exist.

Content analysis is a social science methodology that examines the content of communication; it is used to analyze transcripts of interviews for content and meaning [8]. The method is also used in the humanities to study authorship and authenticity of the meaning of the media used. Stated briefly, "content analysis is any technique for making inferences by objectively and systematically identifying specified characteristics of messages" ([9], page 14). Holsti [9] offered

* Corresponding author.
E-mail address: max.houck@mail.wvu.edu (M.M. Houck).

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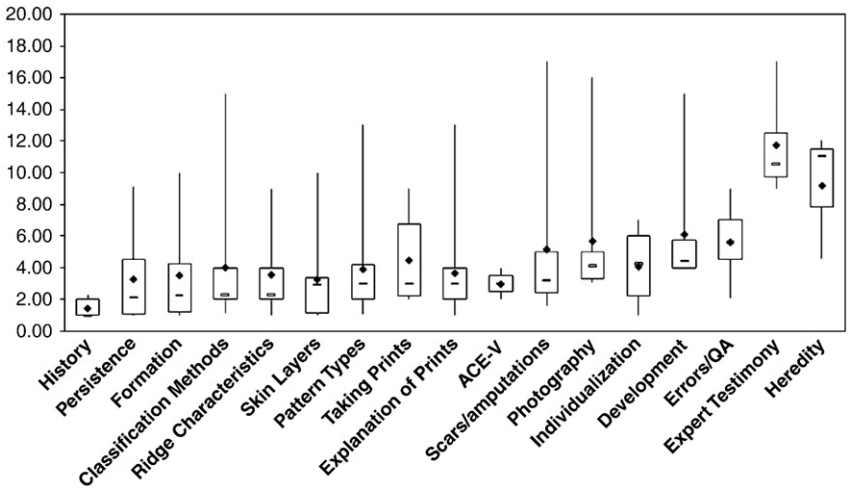

Fig. 1. Raw scores ranked according to topic.

three basic categories of content analysis, relating to the inferences that can be made about:

- the antecedents of communication (disputed authorship or analyze traits of the author, for example),
- the characteristics of communication (techniques, style, comparison of content to standards, and patterns, among others), and
- the effects of communication (readability, transmission rates, responses to message, for example)

In the current study, content analysis was used in the sense of the second category, with an eye towards comparing the content of published sources on fingerprints to each other.

Words and phrases used most often reflect what is considered to be important in the given context. Although content analysis examines what is essentially a qualitative medium (speech, text, images, or other media), the analysis involves quantitative methods relating to use and importance, such as word counts and frequencies, spatial analysis (column inches in a newspaper or magazine, for example), or time analysis (minutes in a television or radio broadcast, for instance). The goal of content analysis is a comprehensive review of the data as defined, the context within which they appear, and the intended audience [10]. The additional benefit to using published sources is that they are public and available for comment and review. While this is not the same as a structured consensus from a target group, content analysis has the bonus of accumulating information and knowledge over long periods of time and is accessible as a resource through purchase and libraries.

Table 1
Descriptive statistics for chapter topics: median, upper quartile, minimum, maximum, lower quartile, and mean.

	Median	Upper Q	Min	Max	Lower Q	Mean
History	1.00	1.00	1.00	2.30	2.00	1.47
Persistence	2.15	1.08	1.00	9.10	4.50	3.31
Formation	2.25	1.20	1.00	10.00	4.28	3.55
Classification methods	2.30	2.00	1.13	15.00	4.00	4.04
Ridge characteristics	2.30	2.00	1.00	9.00	4.00	3.59
Skin layers	2.95	1.18	1.00	10.00	3.40	3.30
Pattern types	3.00	2.00	1.10	13.00	4.20	3.93
Taking prints	3.00	2.25	2.00	9.00	6.75	4.50
Explanation of prints	3.00	2.00	1.00	13.00	4.00	3.69
ACE-V	3.00	2.50	2.00	4.00	3.50	3.00
Scars/amputations	3.20	2.40	1.60	17.00	5.00	5.19
Photography	4.12	3.34	3.13	16.00	5.00	5.70
Individualization	4.25	2.23	1.00	7.00	6.00	4.10
Development	4.40	4.00	4.00	15.00	5.75	6.13
Errors/QA	5.60	4.50	2.10	9.00	7.00	5.64
Expert testimony	10.50	9.75	9.00	17.00	12.50	11.75
Heredity	11.00	7.80	4.60	12.00	11.50	9.20

3. Methods and materials

Nine well-recognized books on friction ridge analysis were reviewed and their tables of content analyzed for topics and content [1,11–18]. Books were chosen across the range of decades of fingerprinting publication to capture changes over time and to also moderate “fashionable” topics that may appear at either end of the timeline. The ordinal numbering of the book chapters in the tables of content was taken as a de facto organization of an information hierarchy. The chapters and subheadings were assigned numerical values in increasing order to quantify their first appearance, location, and order. The lower the value, the more fundamental the topic is to the learning process; the higher the value, the more complex the topic is assumed to be, requiring lower-order information to make it sensible.

4. Results

The raw scores were tabulated and ranked according to topic and by source (Fig. 1). Descriptive statistics were developed (mean, median, mode, and standard deviation) to describe the topics' priority in the published works (Table 1). Median values were also derived (Fig. 2); marginal differences appear between the median and mean values of the data (Fig. 3), indicating few strong outliers [19]. According to the nine books studied, “history” is found first before nearly all other topics. Next most often on average (median values) are persistence, formation, and classification of ridge patterns. The mode yields how often a particular topic is found in the sources (Table 2). History, persistence and formation of fingerprints were commonly found within the first chapter. Ridge characteristics and the explanation of prints were frequently discussed in the second chapter, shortly followed by the process of taking prints and skin layers in chapter 3. Development, photography, and individualization of fingerprints were commonly found chapters 4, 5, and 6, respectively.

The standard deviation corresponds to how far topics deviate from the mean value (Fig. 4). The topics that have the highest standard deviation—that is, occur more variably in their positions in the text—