2: Electrostatics

2.1 Principle of linear superposition. Because the electric field depends linearly upon q, various charges superimpose to produce the electric field.

Essentially, what the principle of linear superimposition says is this: Electrostatic forces (Fields) superimpose. Mathematically this means that if $\vec{F}_j$ arises from several different charges, q_i but not from q_j , then the resultant force is given by:

$$\vec{F} = \sum_{\text{all } q_i,\ \text{not } q_j} \vec{F}_i$$

Your author makes a good point: this is an experimental observation that holds, not a scientific necessity.

2.1.2 Coulomb's law.

I will retain my notation here, and avoid the script r that your author uses. The force on charge q_p due to charge q_i is given experimentally by Coulomb's law:

$$\vec{F}_{pi} = k\frac{q_i q_p}{r_{ip}^2}\hat{r}_{ip} = \frac{1}{4\pi\epsilon_0}\frac{q_i q_p}{r_{ip}^2}\hat{r}_{ip}$$

Note please that $k\mu = 8990\ Nm^2/C^2$ and $\varepsilon_0 = 8.85 \times 10^{-12}\ C^2/Nm^2$.

My notation has $\vec{r}_{ip} \equiv \vec{r}_p - \vec{r}_i$ which is the separation vector pointing from charge i towards charge p. Remember, to obtain the unit vector we do this:

$$\hat{r}_{ip} = \frac{\vec{r}_{ip}}{|\vec{r}_{ip}|}$$

and this points in the same direction as a line drawn from charge i towards charge p. Very soon, p will represent a point in space.

According to your author, this is the complete physical input for electrostatics. The rest is math. Probably this is closer to the truth than not.

2.1.3 Electric Field.

When we apply the principle of linear superimposition for Coulomb's law, the force is given by:

$$\vec{F}_p = \sum_{i=1, i\neq p}^{n} k\frac{q_i q_p}{r_{ip}^2}\hat{r}_{ip} = q_p \sum_{i=1, i\neq p}^{n} k\frac{q_i}{r_{ip}^2}\hat{r}_{ip}$$

It is the last part that we call the electrostatic or electric field at a point p in space:

$$\vec{E}_p = \sum_{i=1}^{n} k\frac{q_i}{r_{ip}^2}\hat{r}_{ip}$$

so that the connection between electrostatic force and electrostatic field is:

$$\vec{F}_p = q_p \vec{E}_p$$

But in fact, the p means slightly different things: The force is acting upon charge p due to the electric field at the point p which is where charge p is placed. I don't think this slight variation in meanings hurts things at all.